Research Project Title: Efficacy of cleaning interventions for domestic and professional kitchen surfaces

Student Presenter: Kevin Mo

Faculty Mentor: Ilic No

Faculty Mentor Department: Sanja

Research Abstract: Introduction:

Food safety continues to be of the highest importance to public health. While consumption in restaurants continues to grow in the US with one half of total food expenses in 2013 spent on food away from home, foodborne illnesses linked to restaurant contamination continue to be high. In foodservice, surfaces can easily become contaminated with human pathogens from raw foods or food handlers. Effective cleaning of food contact and dining surfaces is essential to prevent contamination. Novel microfiber single use cleaning towels are available at the market for use in foodservice. However, their efficacy in removal of human pathogens is not known.

Objective:

Determine the effectiveness of a novel microfiber towel in removing of Listeria monocytogenes and Salmonella spp. from kitchen surfaces: stainless steel, bamboo and pressed paper.

Methods

A total of 18 treatments were completed to test removal rates of Listeria monocytogenes cocktail and Salmonella spp.. Coupons (5cm2) of stainless steel, press paper, and bamboo surfaces were spot inoculated with either L. monocytogenes inoculum or Salmonella inoculum. Each dried contaminated coupon surface was wiped with a one-use microfiber towel with either water, 200 ppm quaternary ammonia, or dry microfiber towel. After wiping, the removal rates from contaminated surfaces were measured. Each treatment was repeated 8 times. Pathogen concentrations were calculated and data was analyzed in Excel and SPSS. Non parametric tests were used to compare the groups.

Results:

Water wipes were more effective in removing all types of bacteria from surfaces than dry wipes (P<0.001). There was no increase in efficiency when quaternary ammonia was used (P=0.238). Water wipes removed L. monocytogenes and Salmonella from stainless steel with similar efficiency (P=1.000). Stainless steel was easier to clean than pressed paper (P<0.001); greater cleaning effectiveness from stainless steel and bamboo was observed (P=0.217) for all types of bacteria.

Conclusions:

Overall the most successful treatment was removing L. monocytogenes from stainless steel using a water moist wipe, and the least successful treatment was removing Salmonella from pressed paper using a dry wipe. Further studies should be done to gather more information on how it performs under different conditions.
Research Project Title: Development and characterization of a children's beverage using by-products from the dairy industry.

Student Presenter: Ayna Arora

Faculty Mentor: Rafael Jimenez-Flores

Faculty Mentor Department: Food Science and Technology

Research Abstract: The study aims to develop a children’s beverage repurposing 2 dairy byproducts, namely acid whey from cottage cheese production and buttermilk. This beverage will serve as a healthier alternative to other products that provide little nutrition. The by-products being researched have high nutritive value due to the presence of protein and milk phospholipids. However, they have undesirable flavors and currently have no significant use in the dairy industry, and through this beverage formulation, they can be used in a potentially profitable manner. This research aims to achieve this beverage by improving the organoleptic properties of these by-products through physical processing to increase palatability. The acid whey has been treated using two methodologies in order to improve the organoleptic properties by reducing volatiles present, and is mixed with spray dried buttermilk and held at 70C for 1min to result formulations with 10%, 11% and 15% total solids. Treating acid whey at 52C at 80mbar pressure to achieve a 33% volume reduction increased the solids content by 4.48%. However, as a consequence, the acid was concentrated which resulted in non-desirable organoleptic properties such as poor texture due to precipitation of buttermilk. Conversely, acid whey treated by ultrafiltration to achieve a 50% volume reduction using a membrane with a molecular weight cut-off of 10 kDa, increased the solids by 0.75% (retentate) and a lower acid content and better organoleptic properties compared to the sample treated by low pressure evaporation. Acid whey and buttermilk beverage samples at 11% total solids were perceived to have the most acceptable textural properties, regardless of the processing of acid whey. Further research will pursue combining the two methodologies to obtain a low-acid and low-volatile profile to yield better organoleptic properties.
Research Project Title: Savings program reduces financial pressures of low-income families with food insecure children

Student Presenter: Madeleine Drost

Faculty Mentor: Cäzilia Loibl

Faculty Mentor Department: Consumer Sciences

Research Abstract: Background: This study investigates whether the Individual Development Account (IDA) program, a federally-funded asset-building program, can relieve the financial pressures experienced in families with food insecure children. Two research questions were assessed: Which financial pressures are associated with children's food insecurity? Can graduation from the IDA program attenuate the association of food insecurity and financial pressures among families whose children are food insecure?

Methods: In 2013, a phone survey was conducted of 405 households with children in seven states who graduated or dropped out of the IDA program in the past seven years. Eleven outcome variables assessed financial management skills and financial pressures related to saving (4 measures), borrowing (5 measures), and material deprivation (2 measures). The survey used the established U.S.D.A. questions to measure children's food insecurity.

Results: Children in 250 IDA families were food secure, children in 72 were marginally food insecure, and children in 83 were severely food insecure. Regression results showed that families with marginally food insecure children who were able to complete the IDA program (instead of dropping out) were better able to save and pay bills on time, were more likely to hold a savings account, had lower amounts of loans from family, and had to be less frugal. Further, graduates of the IDA program whose children were severely food insecure were better able to save, pay bills on time, had to be less frugal, had lower credit card balances, better access to bank loans, and were better able to afford expenses of everyday living when compared to program dropouts with severely food insecure children.

Conclusions: Our findings show that if families with marginally food insecure children had been able to complete the IDA program, they had reduced financial pressures with regard to 4 of 11 indicators of saving, borrowing and deprivation. Families with severely food insecure children also had reduced financial pressures with regard to 5 out of 11 indicators of borrowing and material deprivation. Our study thus documents the benefits of the IDA program's financial education, one-on-one credit repair, regular savings and asset purchase requirements for even the most financially fragile families.
Research Project Title: In vitro analysis of mushroom proteases that may tenderize beef

Student Presenter: Jing-Wei Lee

Faculty Mentor: Eric England

Faculty Mentor Department: Meat Science

Research Abstract: Meat tenderness is an important characteristic that influences consumer purchasing decisions. Protease extracts from pineapple, ginger, papaya and kiwi have exhibited proteolytic activity to tenderize meat products. Unfortunately, many of these proteases have broad activity that can over-tenderize the meat and negatively affect texture and quality. Therefore, identification and evaluation of other proteases capable of tenderizing beef is necessary. Previously, mushrooms have been shown to enhance flavor and nutritional composition of meat dishes, as well as having beneficial antioxidant and health effects. Mushrooms also contain a variety of proteases that were analyzed in this study for their ability to denature beef proteins using an in vitro model system. Eight mushroom varieties were tested including white button (white immature Agaricus bisporus), crimini (brown immature Agaricus bisporus), portobello (mature Agaricus bisporus), shitakke (Lentinula edodes), enoki (Flammulina velutipes), oyster (Pleurotus ostreatus), king trumpet (Pleurotus eryngii), and brown beech (Hypsizygus tessellatus). Mushrooms were homogenized in a 20 mM Tris buffer (pH 8.0), filtered, then centrifuged. Afterward, purified bovine myofibrils were combined with the crude mushroom protease extracts and incubated at 25°C. Samples were collected at 0, 30, 60, 240, and 1440 min. After, myofibrillar proteins were solubilized and separated using SDS-PAGE. Density of protein bands were quantified and compared between the time-points. The data indicated that all eight mushroom varieties proteolyzed myofibrillar proteins including actin and myosin. Therefore, these results support the possibility that mushroom proteases may be able to tenderize beef, forming the basis for future research trials.
Research Project Title: A comparative study of color change assessment for frozen ground beef patties using traditional colorimeter and digital image analysis

Student Presenter: Xiang Li

Faculty Mentor: Dennis Heldman

Faculty Mentor Department: Food Science and Technology

Research Abstract: Color change of beef is a major quality concern since a loss in redness indicates protein oxidation. Compared with traditional colorimeter methodologies, digital image processing techniques not only saves in labor costs but also results in more objective measuring results. The goals of this study were to determine if a traditional colorimeter methodology and digital image processing software correlate with each other, then to determine the most precise method. The hypothesis was that the greater area analyzed in the image processing technique would result in a lower sample to sample variance than the traditional colorimeter while overall color scores will correlate.

Frozen beef patties were stored at three temperatures with three freezers replications at each temperature. Data collection and analysis were conducted once a month, and L*a*b* coordinates were recorded in triplicate using a Minolta colorimeter on three patties from each replicate under each temperature. Digital images were captured on 6 beef patties of each replicate using a Cannon EOS T6 camera. RGB data (mean and standard deviation) was obtained through ImageJ with Region of Interest (ROI) selections representative of the patty. Comparison of the two methods was conducted by analyzing the variance present in the redness values between the three replicate freezers at a given storage condition then summarizing the variance of multiple conditions.

Standard deviation data of redness scale for both methods were obtained already for 9 specific conditions (-10°C, -15°C, -20°C; Month 1, month 2, month 3). It was averaged and the comparison showed that the average of standard deviation was 0.7 for colorimeter a* value and 2.9 for RGB red histogram.

Colorimeter a* value produced more precise results, which was opposite to the hypothesis. The less variability of colorimeter a* value could be an alert that this method was missing color variations present away from the measuring locations.
Research Project Title: The effects of dietary fat intake on endothelial dysfunction in hypertensive women

Student Presenter: Mallory Jackson

Faculty Mentor: Cindy Anderson

Faculty Mentor Department: Nursing

Research Abstract: High fat diets lead to low-grade systemic inflammation, a known cause of endothelial dysfunction and hypertension. Current research suggests that dietary modifications, including increasing unsaturated and lowering saturated fat intake, effectively treat hypertension. Adherence to recommendations to promote heart health can be low and influenced by factors such as age. This study was designed to examine associations among dietary intake of heart-healthy (i.e., monounsaturated, polyunsaturated) and heart-unhealthy (i.e., saturated) fats and endothelial function in hypertensive women as well as the predictive value of age for dietary fat intake. This secondary analysis utilized data obtained from a pilot study designed to examine indicators of vascular function in chronic hypertension. A convenience sample of 11 women aged 30-60 years was enrolled. The Diet History Questionnaire II (DHQII) was used to measure typical fat intake over a 30-day period. Endothelial function was measured using an Endo-PAT (Itamar Medical; Israel) and based on reactive hyperemic index (RHI). Spearman rank-order correlations were examined to determine the relationships among age, dietary fat intake, and endothelial function (α=0.05). Mean dietary intake of monounsaturated, polyunsaturated, and saturated fats was 23.199 grams 12.217, 13.4 grams (SD 9.0), 18.7 grams (SD 8.3), respectively. Monounsaturated (rs=0.50, p=0.12), polyunsaturated (rs =0.49, p=0.13), and saturated fat intake (rs=0.49, p=0.13) showed a trend toward improved vascular function, though no statistically significant association was identified. Greater age was associated with significantly less polyunsaturated (rs =-0.60, p=0.05) and monounsaturated (rs =-0.66, p=0.03) fat intake and marginally less saturated fat intake (rs =-0.48, p=0.14) intake. This study advances understanding of the influence of dietary fat consumption, which can be adapted as an early intervention to endothelial dysfunction and by extension, hypertension and cardiovascular disease. Dietary fat intake was not associated with endothelial function though this study was limited by small sample size. Future studies examining the relationship between dietary fat intake, vascular function and the role of unmodifiable factors such as age are warranted.
Research Project Title: A comparison of the use of food records and added sugar intake with lean and obese postmenopausal women

Student Presenter: Madelyn Joviak

Faculty Mentor: Tonya Orchard

Faculty Mentor Department: Human Nutrition

Research Abstract: Introduction

Accurate records of added sugar (AS) intake are difficult to keep. Valid and reliable biomarkers of added sugar consumption are needed to study its relationship to disease. This project’s objective is to test the ability of a dietary biomarker, urinary sucrose, to detect changes in AS intake in lean compared to obese postmenopausal women.

Methods

Healthy, postmenopausal women were recruited from the Franklin County area; 15 lean (BMI 18.5-24.9 kg/m2) and 15 obese (BMI ≥30 kg/m2) women were enrolled. This study used a pre-post test, single group design. An initial visit was conducted to determine eligibility, obtain informed consent, and collect anthropometric, demographic, and lifestyle data. Participants completed two separate 24-hour food records of usual dietary intake followed by fasting morning urine collections. Record collection days were one week apart, and a sugar-sweetened beverage was added to usual intake on the second day. The Nutrition Data System for Research (NDSR) was used to analyze food records. Urinary sucrose excretion was analyzed using a modified enzymatic assay.

Results

Lean participants had a mean (SD) age of 61.1 (5.26) years, BMI of 23.4 (2.04) kg/m2, and Leisure Activity Score of 41.0 (29.4). Among lean participants, 100% were white, 53% were married, 47% worked full-time, and 73% never smoked. Obese participants were 58.9 (4.56) years old, with BMI of 37.96 (5.42) kg/m2, and Leisure Activity Score of 28.7 (23.6). Among obese participants, 87% were white, 67% were married, 27% worked full-time, and 67% never smoked. Initial analyses show pooled fasting urine samples for lean participants contain mean (SD) sucrose levels of 0.063 (0.095) g/L on Day 1 and 0.028 (0.020) g/L on Day 2, while samples from obese participants had 0.023 (0.019) g/L on Day 1 and 0.020 (0.016) g/L on Day 2. Research is in progress to evaluate urinary sucrose excretion and dietary intake of AS between lean and obese participants.

Conclusion

Urinary sucrose levels are detectable among lean and obese healthy postmenopausal women using an enzymatic assay, and may hold promise as a possible biomarker for AS consumption. Future research is needed to validate this method among additional populations.
Research Project Title: Consumer acceptability of blueberry confections formulated with blueberry extract and lyophilized whole blueberry powder

Student Presenter: Haley Orwig

Faculty Mentor: Yael Vodovotz

Faculty Mentor Department: Food Science and Technology

Research Abstract: Functional food products (FFP) have been shown to enhance overall health and aid in disease prevention. FFP’s, aside from delivering the intended health benefit, need to be sensory acceptable so that they are regularly consumed. Confections make excellent FFPs and delivery vehicles for bioactives due to their high consumer compliance, and their ability to deliver a consistent composition of phytochemicals even after processing and storage. Blueberries contain polyphenols, primarily anthocyanins, which have been shown to have anti-inflammatory properties and other health benefits. However, most of the pre-clinical evidence regarding the health benefits of blueberries have been seen using a phytochemical-rich blueberry extract, not the whole fruit. When assessing possible blueberry sources in a functional confection, whole lyophilized blueberry powder was selected, delivering equivalent phytochemical profiles without the chemical off-flavors attributed to the extract. It was hypothesized that confections made with lyophilized whole blueberry powder would be preferred to the confections made with blueberry extract. Therefore, the objective of this study was to conduct a sensory analysis of the two confections, including a paired preference test and an acceptability test using a 9-point hedonic scale rating overall liking, aroma, fruit flavor, bitterness, graininess, texture, and sweetness (n=75), with a significance level of α=0.05. Results of the preference test showed no significant preference among the two blueberry confections, with 43 individuals preferring the whole blueberry powder confection and 32 individuals preferring the blueberry extract confection. No significant differences were seen among hedonic scores except in graininess (p= 0.015) and average overall liking scores of both confections fell in the “like slightly” category (powder= 6.33, extract= 6.21). In conclusion, both the extract and powder confections were sensory acceptable for use in future clinical trials, but more work needs to be done comparing shelf stability and phytochemical uptake in humans.
Research Project Title: Nutrient intakes among a pediatric cohort meeting the AND/ASPEN diagnostic criteria for malnutrition

Student Presenter: Angela Parillo

Faculty Mentor: Holly Estes

Faculty Mentor Department: Medical Dietetics

Research Abstract: Introduction/Background: Pediatric malnutrition may be widely under-recognized due to inconsistency of diagnostic standards. In 2014, the AND/ASPEN published a consensus statement proposing a new set of diagnostic criteria in order to establish a universal approach. The purpose of this study is to apply these criteria to determine the prevalence of pediatric malnutrition, while analyzing nutrient intakes across age groups and malnutrition indicators.

Methods: A cross-sectional analysis from the 2005-2014 National Health and Nutrition Examination Survey of 12,611 children ages 1-13 years. Body measurement data included weight, length/height, and mid-upper arm circumference. Data was analyzed using Epi Info and compared to AND/ASPEN diagnostic criteria for malnutrition using a single data point. Dietary intake was assessed by 24-hour recall. Data was weighted to determine estimates that were representative of the national population. A one-way analysis of variance was used to compare nutrient intakes across age groups and malnutrition status.

Results: Of the total sample, 11.0% had indicators of mild malnutrition, while 2.4% had indicators of moderate/severe malnutrition. One-year-olds had the highest prevalence of malnutrition, with 21.0% and 4.1% meeting criteria for mild and moderate/severe malnutrition respectively. Though most mean nutrient intakes exceeded recommended intakes, the percentage of children not meeting nutrients recommendations was problematic across all age groups and malnutrition indices. Vitamins E and D were the nutrients most frequently under-consumed across all age groups and malnutrition categories. Among one-year-olds, the most frequently under-consumed nutrients were vitamin D, vitamin E, and iron. Iron intakes improved with age, while percentages of children not meeting RDAs for calcium and zinc increased with age.

Conclusion: Malnutrition was prevalent in the nationally-representative sample. Across all age groups and malnutrition categories, many subjects did not meet the DRIs for key nutrients, particularly vitamin E and vitamin D. While this is concerning among the general U.S. pediatric population, poor nutrient intake may lead to further growth deficits in those already indicating malnutrition. Further research is needed to determine effective interventions for improving diet quality among pediatric populations to optimize growth.
Research Project Title: A literature review assessing the impact of food insecurity on early childhood mental health: an emphasis on ADHD

Student Presenter: Stacy Lu

Faculty Mentor: Irene Hatsu

Faculty Mentor Department: Department of Human Sciences

Research Abstract: As of 2016, there are 6.5 million children in the United States living in food insecure households, yet there exists limited research describing the psychiatric consequences of this public health crisis. The World Food Summit defines food security as "the ability to access sufficient quantities of safe and nutritious foods for an active and healthy lifestyle at all times." Thus, food insecurity exists when the opposite is true—lacking food availability, access, utilization, and stability. Currently, there is limited research exploring associations between food insecurity and early childhood mental health disorders such as Attention-Deficit Hyperactivity Disorder (ADHD). Symptoms of inattention, hyperactivity-impulsivity, and aggression are characteristic of ADHD, which affects approximately 5 percent of children. Early childhood exposure to environmental stressors related to food insecurity could be associated with predisposing or exacerbating ADHD symptoms in children, yet literature exploring this relationship is scarce. Research in this field lacks validated and reliable assessments to accurately measure mental health symptoms, making it more difficult to investigate connections with psychological diagnoses such as ADHD. None of these studies use full food insecurity questionnaires to capture the children’s food insecurity status separately from that of the household. Additionally, many of these studies do not control for variables that may impact the relationship between food insecurity and mental health, such as socioeconomic status, race, age, and parental education. The purpose of this review is to address the gap in literature of food insecurity and early childhood ADHD symptom prevalence and severity. Literature for this review was pulled from PubMed, and the Ohio State University library database, with a focus on food insecurity and children’s symptoms of inattention, hyperactivity-impulsivity, and aggression, which may be indicative of an ADHD diagnosis. Our primary aim is to advocate for future research that may further characterize this complex relationship and inspire future community or public health interventions addressing food insecurity in children with ADHD.
Research Project Title: Corn: a cultural shift in American identity due to severe food insecurity

Student Presenter: Dana Outcalt

Faculty Mentor: Jeffrey Cohen

Faculty Mentor Department: Anthropology

Research Abstract: The story of Thanksgiving is a more complicated and complex story than the tale of peaceful beginnings that is typically associated with the Pilgrims’ meals shared with Native Americans. The story of the pilgrims’ first years included tragic death, severe food insecurity and a politically charged meal that brought enemies together. The first Thanksgiving is a tale of a dramatic shift in American identity and culture as pilgrims struggled to survive in a harsh, unfamiliar world. Corn, a food source associated with poverty, simplicity and demeaned as "native" and unworthy of European palettes became a central staple in the diet and a central feature in a shared American identity. Yet, it was the death of half the pilgrim’s colony and their lack of preparation (as they faced starvation and uncertainty) that introduced corn to the American diet. Today, corn has become interwoven into our diet and American consumerism. My poster documents this surprising and dramatic shift and follows the corn as it goes from a hated food source to become an integral iconic part of the American identity.
Research Project Title: Investigating the impact of functional pretzel snack on satiety in postmenopausal women with metabolic syndrome

Student Presenter: Daniel Sosh

Faculty Mentor: Yael Vodovotz

Faculty Mentor Department: Food Science and Technology

Research Abstract: Snacking makes up a significant portion of caloric intake and has been associated with contributing to the obesity epidemic. One possible solution is a nutritious functional snack food, designed to prolong satiety (state of fullness and inhibition of continued eating). Nutrient composition and physical properties of the food have an important role in satiety. Specifically, soy has unique physicochemical characteristics which prolong satiety and long-chain fatty acids such as linoleic acid have shown to inhibit gastric emptying. Therefore, three functional pretzels (wheat-control, wheat-safflower oil, and soy-safflower oil) were developed to evaluate the impact of high-linoleic safflower oil with and without soy on satiety. We hypothesized the synergistic combination of soy and high-linoleic safflower oil in a functional pretzel would prolong 6-hour post-prandial satiety in overweight, postmenopausal women (n=18) with metabolic syndrome. The two objectives of this study were: 1. To measure postprandial satiety over 6 hours with each of the three pretzels using blood glucose and vertical visual analogue scales (VAS). 2. To evaluate changes in apparent viscosity using rheometry of three pretzels during a 6-hour ex-vivo, gastric digestion. Although no significant difference was found in blood glucose AUC among the three pretzels, blood glucose at 120 minutes during soy-safflower oil pretzel intervention showed significantly lower blood glucose levels (95±3.1 mg/dL) than wheat-control (111±5.2 mg/dL) and wheat-safflower oil (112±6.3 mg/dL). Among the nine attributes of satiety investigated, paired t-test showed soy-safflower oil significantly suppressed hunger compared to wheat-control (p=0.0001) or compared to wheat-safflower oil (p=0.0016). Apparent viscosity of gastric digested pretzels are currently being correlated with clinical findings. The lower glycemic response and prolonged satiety demonstrate soy and high-linoleic acid safflower oil containing functional ingredients show promise in decreasing satiety. Incorporation of these functional snack foods into the diet could increase satiety and improve snacking behavior.
Research Project Title: Bitter taste sensitivity and naringin concentration on consumer preference of agar confections

Student Presenter: Milena Rajcevic

Faculty Mentor: Vodovotz Yael

Faculty Mentor Department: Food Science and Technology

Research Abstract: Early studies have shown that diets rich in naringin may potentially ameliorate obesity by enhancing β-oxidation of fatty acid. Evidence shows individuals with bitter taste sensitivity avoid bitter fruits and vegetables such as naringin-rich foods like grapefruit and arguably, those with bitter taste sensitivity may have a greater risk of obesity. In recent decades, US consumption of grapefruit has experienced a dramatic decline largely from consumers’ misconceptions on their food-drug interactions. Therefore, five functional confections (apple, low and high dose tomato or grapefruit confections) with varying concentrations of naringin (0 to 206mmol/l) were developed to investigate their consumer acceptance and assess the impact of bitter taste sensitivity on scoring attribute intensity. We hypothesize consumers with a higher bitter taste sensitivity will have a greater preference/acceptance for confections having lower quantities of naringin. The following objectives will be met:

1. To evaluate consumer acceptance of five confections using a 9-point Hedonic scale in bitter and non-bitter tasters.
2. To discern if bitter taste sensitivity effects attribute intensity scoring in quantitative descriptive analysis (QDA).

Once IRB approval was obtained, adult men and women (n=75) were asked to evaluate consumer acceptance and characterize attribute intensities using QDA. Dried paper strips of 6-n-propyl-thiouracil (25 and 50mmol/L) were used to stratify bitter tasters. An exploratory K-means cluster analysis was used and resulted in 5 clusters ranging from super sensitive bitter tasters (SSBT) to non-bitter tasters. Independent of bitter tasting status, apple confections were the most preferred (p<0.05) and accepted (p<0.001) while high-dose grapefruit was the least. Hedonic scores for apple confection provided by SSBT were significantly greater (p=0.033) than other bitter tasting groups. Although the differences in the QDA scores were modest among bitter taster groups, bitterness intensity scores for low and high dose grapefruit confection were significantly higher (p<0.05) in SSBT than in any other. The results obtained provides insight into bitter taste sensitivity with naringin-rich foods while increasing consumer acceptance and clinical adherence for future use. Integrating naringin-rich ingredients such as tomato into a functional confection increases the availability of naringin-rich food products for future clinical trials and eventually to the functional food market.
Research Project Title: Perceptual differences of aromas delivered through the orthonasal and retronasal routes

Student Presenter: Margaret Stegman

Faculty Mentor: Christopher Simons

Faculty Mentor Department: Food Science and Technology

Research Abstract: Aroma can be perceived through two routes: orthonasal (through the nose) and retronasal (through the mouth). The stimuli elicit signals that eventually reach the same receptors in the olfactory epithelium. However, previous studies suggest there is a perceptual difference between the two routes although the results are inconclusive. In this study, a matching paradigm was designed to control for memory bias and isolate the potential perceptual difference between aroma delivery routes. Panelists performed four matching paradigms of four different strawberry flavors (candy, woody, ripe, and green). The similarity of the four strawberry flavors required panelists to profile each sample to identify acute differences. This increased the cognitive demand required to complete the match. Subjects were given the four strawberry reference standards and told to either smell the sample orthonasally or taste it retronasally. Subjects then matched each reference to one of the four other blind-coded samples by either smelling or tasting congruently (same method) or incongruently (different methods). The retronasal samples consisted of 30 mL aqueous solutions in 2oz black sample cups, while the orthonasal samples consisted of 10 mL aqueous solutions in a capped glass vial wrapped in aluminum foil to minimize visual differences. When matching the reference to unknown samples using congruent evaluations, the panelists performed similarly in the orthonasal and retronasal tests (p=0.450) indicating they could correctly identify matching flavors. Performance significantly decreased when performed incongruently (p<0.002), suggesting there is truly a difference in perception when the same aromas are delivered via different routes. More knowledge regarding how people perceive aromas and flavors, and how these stimuli relate to one another, will enable the food industry to better optimize the sensory properties of foods and beverages.
Research Project Title: Geospatial analysis of food purchasing and consumption patterns in Leon, Nicaragua

Student Presenter: Francesca Scali

Faculty Mentor: Julie Field

Faculty Mentor Department: Anthropology

Research Abstract: Food insecurity (FI), or the inability to access sufficient quantities of nutritious and culturally valued foods, is a dynamic condition which can cause and perpetuate various health concerns. The frequency at which households are able to access and afford to shop for food is an important consideration regarding FI. Drawing upon data collected in 2012 by researchers from The Ohio State University and the Autonomous National University of Nicaragua - Leon, this study examines the geographic nature of FI at the household and community levels. Very few analyses of FI have been conducted in Central America, none of which have examined the geospatial patterning of FI. The focus of this study is to explore how the frequency of food shopping for the household influences the diversity of foods consumed, physical measures of health in children, and perceived food insecurity in mothers. Using GIS as a means of symbolizing and statistically analyzing the spatial aspects of these data, households in rural areas are shown to shop for food less frequently, report consuming less fresh vegetables and fruits, and report higher levels of perceived food insecurity. These patterns help to explain the high clusters of anemia in rural areas, while other measures of health indicators appear more dispersed.
Research Project Title: Introduction of complementary foods to premature infants during the first year of life

Student Presenter: Hallie Straka

Faculty Mentor: Deborah Steward

Faculty Mentor Department: Nursing

Research Abstract: Introduction/Background: During the first year of life, questions arise as to when complementary foods should be introduced to premature infants. Debate centers on whether actual age or corrected age should be used. Guidelines specify that complementary foods should be introduced between 4-6 months corrected age. Mothers are usually the decision-maker in relation to the introduction of complementary foods. What is unclear are the factors that influence maternal decision-making. The purpose of this study was to understand maternal reasoning in relation to the introduction of complementary foods to their premature infants. The Theory of Planned Behavior guides exploration of the psychosocial influences on the behavioral intention of mothers to introduce complementary foods to their premature infant.

Methods: A secondary analysis was conducted of interview data from 21 mothers who participated in a study to understand mothers’ intentions to feed their premature infants. In the original study, mothers of very low birthweight (birthweight less than 1500 grams) infants were recruited prior to discharge from the neonatal intensive care unit. Mothers were interviewed when their infants were at 1, 4, 8, and 12 months corrected age. All interviews were transcribed verbatim. Three key concepts from the Theory of Planned Behavior guided the secondary analysis of the interview data: behavioral beliefs, normative beliefs, and control beliefs.

Results: Overwhelmingly, mothers introduced complementary foods earlier than recommended. Maternal behavioral beliefs centered on the benefit to their infants. Perceived benefits included enhanced sleeping at night, improved growth, and remaining “full” longer. The influence of normative beliefs was demonstrated by strong reliance on the advice of peers including friends and relatives. Few mothers followed the pediatrician’s recommendations. Mothers’ control of introducing complementary foods was influenced by interpretation of their infant’s readiness cues, concern over infant hunger, and trust in their own judgement.

Conclusion: Mothers believe that they know what is best for their infant and make decisions based on this principle. Research is needed to understand why mothers readily follow the advice of peers and are reluctant to follow established guidelines.
Research Project Title: Anthocyanins' Behavior in a Lotion Base at Various Concentrations

Student Presenter: Zihan Zhang

Faculty Mentor: M. Monica Giusti

Faculty Mentor Department: Department of Food Science and Technology

Research Abstract: Anthocyanins are natural colorants with potential health-promoting properties such that they act as anti-oxidative, anti-inflammatory, and anti-carcinogenic compounds. A recent study found that application of lipstick rich in anthocyanins could potentially provide UV protection and anti-aging benefits, which could positively affect the skin. As lotion can be applied multiple times a day, it could be a potential vehicle for anthocyanin dermal delivery. However, little research has been done on color and stability of anthocyanins in lotions. The purpose of this experiment was to understand the behavior and color expression of anthocyanins from different sources in lotion and to determine the amount of different pigments necessary to display attractive colors. Anthocyanins are more stable and show red color in acidic condition (lower than 3) and as the pH value increases, the color of anthocyanins will fade. As the lotion base was mildly acidic (pH 4.5 to 6), low tinctorial strength was predicted since anthocyanins favor the formation of colorless forms.

In this experiment commercially produced elderberry, bilberry, red cabbage, black carrot and purple corn powders with different anthocyanin compositions were added to the same lotion base in different concentrations. Reflectance color readings were taken with a colorimeter with settings: reflectance specular included, D65 illuminant, and 10-degree observer. CIE-Labch scales were used to analyze the color of the lotion bases and based on the data.

The results showed that all the pigments behaved differently depending on the colorant used, exhibiting different pink-red hues (hue angles of 0.8° to 359.75°) in the lotion base and different saturation levels of color (Chroma ranged from 28.4 to 48.73). Yet, all pigments followed similar patterns. For all pigments, lower than 0.009% w/w of pigments were needed to show intense color and to obtain the saturated Chroma and hue, which showed a much higher tinctorial power than expected.

The results showed that low concentration of anthocyanins was needed to show appealing color in the lotion base. Obtained information can help with determination of the concentration range of an anthocyanin in lotion bases while introducing anthocyanins into new products.
Research Project Title: Reliability and validity of the Expanded Food and Nutrition Education Program (EFNEP) nutrition education survey

Student Presenter: Salam Tiba

Faculty Mentor: Carolyn Gunther

Faculty Mentor Department: Human Sciences

Research Abstract: Background: There is need for valid and reliable tools to assess nutrition and physical activity outcomes in low-income, racial minority children who are at increased risk for obesity.

Objective: The purpose of this study was to determine the validity and reliability of the Nutrition Education Survey (NES), a tool designed to assess diet and physical activity behaviors of participants enrolled in the Expanded Food and Nutrition Education Program (EFNEP), a federal nutrition education program that serves low income families.

Methods: Students in grades pre-K-5th at public elementary schools in low-income neighborhoods of Columbus, Ohio participating in a larger observational study were invited to participate. Data was collected at three time points — beginning (b0) and middle (t1) of summer, and at the beginning of the following school year (t2). Dietary intake and physical activity behaviors were assessed with three 24-hour dietary recalls and Garmin VivoSmartHR activity trackers, along with the EFNEP NES. Reliability was assessed using Cronbach’s Alpha tests for internal consistency. Construct validity was assessed using Pearson correlation tests comparing NES questions to dietary intake and physical activity data.

Results: 62 children representing 42 families enrolled. Mean age was 6.96 ± 0.33. 83.8% reported being Black, and 69.4% were low-income. At baseline, mean daily steps, intensity minutes, and resting heart rate were 8005.33 ± 515.53 (n=44) steps, 63.35 ± 15.59 (n=36) minutes, and 66.93 ± 2.17 (n=41) beats/minute, respectively. 70.9% of participants reported doing physical activity most days or everyday with 50%, and 61.3% reporting an hour or more on weekdays and weekend days. Participants reported engaging in screen time for 3+ hours on weekdays and weekends was 55.7% and 49.2%. Acceptable reliability of the survey was observed with an α=0.75 for all survey items and α=0.67, 0.60, and 0.63 for the nutrition, food safety, and physical activity constructs, respectively. Validity analyses for each time point and nutrition data analyses are forthcoming.

Conclusions: Preliminary data suggest that the EFNEP NES may be a reliable survey for reporting child nutrition and physical activity behaviors.
Research Project Title: Comparative punctate tactile sensitivity reveals human tongue is more sensitive than fingertip

Student Presenter: Morgan Whitecotton

Faculty Mentor: Christopher Simons

Faculty Mentor Department: Food Science and Technology

Research Abstract: The tongue is what helps us participate in conversation and enjoy the food we eat. Yet, its sensitivity to tactile stimuli has not been characterized as completely as other systems, such as the fingertip. Moreover, little work has been done comparing sensitivity of the tongue to other tissues. The purpose of this study was to determine the relative tactile sensitivity of the tongue versus the fingertip to provide insight into the tongue’s mechanosensitivity and neural mechanisms. It was hypothesized that subjects would be better able to discriminate between stimuli with their tongue than their fingertip. Relative tactile sensitivity of the fingertip and the tongue was evaluated in healthy individuals (n=30, 14m/16f, aged 19-28) using the forced-choice, up–down staircase method. In separate conditions, each subject was asked to discriminate between two punctate stimuli (F=0.0044-0.010N) when presented to their finger or their tongue using a Luneau Cochet-Bonnet Aesthesiometer (Western Ophthalmics Corporation, Lynnwood, WA). Reversals were averaged for each condition to obtain just noticeable difference (JND) thresholds and compared using a two-tailed, paired t-test (α = 0.05). The force needed to evoke a JND was significantly (p=0.018) smaller in the tongue (0.0061±0.000096 N) compared to the fingertip (0.0067±0.00022 N). This agrees with the original hypothesis that people were better able to discriminate between stimuli with their tongues, therefore concluding that the tongue is more sensitive. While the reason for the tongue’s heightened sensitivity is unknown, it may reflect the closer proximity of mechanoreceptors to the lingual surface compared to the fingertip allowing for easier discrimination of punctate stimuli. This experiment lays the foundation for other experiments comparing the sensitivity of the fingertip and the tongue, such as roughness and point-and-edge detection, with the overall goal of determining the mechanisms behind texture perception associated with the consumption of foods and beverages.
Research Project Title: Transportation and distribution of food banks and food pantries

Student Presenter: Yidi Wu

Faculty Mentor: Neal Hooker

Faculty Mentor Department: John Glenn College of Public Affairs

Research Abstract: According to data from U.S. Department of Agriculture’s “Household Food Security in the United States in 2014,” Ohio had the third lowest food security across United States. To ease food insecurity, some non-profit, charitable organizations, such as food banks and pantries, distribute food to those who have difficulty purchasing enough to avoid hunger. They act as food storage and distribution depots for smaller agencies in different locations. Although there are many agencies offering food, some people still do not have access to this food because of consumer’s transportation constraints or the organization’s distribution schedule. The purpose of this research is to identify factors related to food insecurity and propose a plan to reduce these problems. This is achieved through exploratory county-level analysis, from 2010 to 2017, to investigate the relationship between food insecurity and other variables such as the number of children, household income, and unemployment rate. Moreover, this research discusses the impact of Supplemental Nutrition Assistance Program (SNAP). The research data come from the Census Bureau, U.S. Department of Agriculture, and food banks within Ohio. Preliminary results show that household’s income is slightly negatively correlated and unemployment rate are positively correlated with the food insecurity rate. Based on these results, it will be easier for agencies to predict the future trend of people with food insecurity. A recent innovation in SNAP, which builds on the cooperation between local grocery stores and Amazon may help those with food insecurity. Findings from this research offer food banks, food pantries, government agencies, and local non-profit organizations more directions to alleviate food insecurity problems.
Research Project Title: Market station

Student Presenter: Erin Achille

Faculty Mentor: Susan Melsop

Faculty Mentor Department: Department of Design

Research Abstract: Market Station is a realistic proposal for a design of an existing historical building in Columbus, Ohio. This research will present the needed concept, programming, and visual design of this space. Fire Station No. 6 located on West Broad Street in Franklinton is the perfect fit for this nonprofit grocery store. The programming in this building will help to alleviate the economic and social issues in the area by addressing the food desert problem. Having a healthy community starts with every individual's personal well-being. By placing a resource for groceries and education in this location, Market Station will be able to reach out to individuals on a personal level. Everyone must eat and what one eats affects his or her mood, energy level, and overall health. By improving all these things, residents will perform better at their jobs and have healthier, happier lives. The market will cater especially to those residents who live beside the building in Franklin Station, a residential community that houses adults with disabilities, and adults who have experienced homelessness. These residents will have easy access to healthy food year-round by just walking next door. Hydroponics and aeroponics will be used in the interior space to grow plants in an urban setting. These sustainable methods are labor-efficient and accessible. Residents and students will be invited to grow and harvest these plants as hands-on learning for academia and for potential employment. Through cooking, farming, and bringing a fully stocked market to this area, Market Station will be able to feed hungry people healthy plant-based meals. Not only will close residents be attracted to the market, but anyone will be able to dine-in and purchase fresh food to experience what Market Station has to offer. The local grocery store will be the "go-to" place because they will sell everything they make from their cooking and urban growing classes.