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Protecting the Global Food Supply



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Dr. Doris D'Souza, PhD

The University of Tennessee Knoxville, Department of Food Science, Knoxville, Tennessee, United States of America

Foodborne viruses, Molecular detection, Microbial inactivation, Pathogen transmission, Antimicrobial resistance

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Dr. Joshua Gurtler, Ph.D.

USDA-ARS, Wyndmoor, Pennsylvania, United States of America

Safety of fresh produce, irrigation water, antimicrobial washes, low water activity foods, crop soil

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Dr. Lauren S. Jackson, PhD

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, College Park, Maryland, United States of America

Food Allergens, Chemical Contaminants, Mycotoxins, Cooking/Heat-Produced Toxicants, Sanitation

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Dina Siedenburg

International Association of Food Protection, Des Moines, Iowa, United States of America

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Dr. Jennifer C. Acuff

STEC, E. coli, Salmonella, Listeria monocytogenes, surrogate microorganisms, low moisture/water activity foods, beef, poultry, validation studies, challenge studies, antimicrobial treatments, post-harvest food safety, thermal inactivation, non-thermal inactivation, decimal reduction times, injury-recovery methodology, inoculation methodology

Assoc. Professor Achyut Adhikari, PhD

Louisiana State University School of Nutrition and Food Sciences, Baton Rouge, Louisiana, United States of America

Compost, raw manure, irrigation water, fresh produce, UVC light treatment, antimicrobials, Weibull model, stress response, chlorine dioxide, peroxyacetic acid, vegetable filter strips, sprouts, pecans, die-off rate, ,



Dr. Ana Allende, PhD

Spanish Scientific Research Council, Madrid, Spain

Fresh produce, Pre-harvest, E. coli, Salmonella, Listeria, Irrigation water, Survival, Inactivation, Risk assessment, water management

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Dr. Avelino Alvarez-Ordóñez, PhD

University of León, Department of Food Hygiene and Technology, Leon, Spain

Antimicrobial resistance, Novel food preservation strategies, Biofilms, Microbial persistence, Microbial stress response, Acid tolerance, Salmonella, Listeria, Fourier Transform Infrared Spectroscopy

Dr. Stella M. Alzamora

Food dehydration and sterilization, Emerging technologies for optimization of food preservation (ultrasound, UVC, pulsed UV light, ozone, natural antimicrobials), flow cytometry, predictive methodology and mathematical modeling of microbial response, control of pathogenic and spoilage microorganisms by traditional preservation methods, micro, nano and ultrastructure of foods, structure, rheology and texture of vegetables, microbial growth and inactivation kinetics

Dr. Nicole Arnold, PhD

The Ohio State University, Columbus, Ohio, United States of America

risk communication, consumer beliefs and perceptions, Qualitative research, social media, food preservation, food labels, (Cooperative) Extension, food retail, consumer knowledge/attitudes/behaviors, food labels and consumer advisory warnings, food processing methods and home food preservation, food policy and regulations, qualitative research methods (surveys, focus groups, observational studies, MDs/DOs, OBGYNs/maternal health professionals etc.), mechanically tenderized beef products, social media and food-related information, food safety, food safety education, food safety training, food service, food safety for healthcare professions

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Dr. Cameron Bardsley, PhD

USDA-ARS Southeastern Fruit and Tree-Nut Research Laboratory, Byron, Georgia, United States of America

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Dr. Teresa Bergholz, PhD

Michigan State University, East Lansing, Michigan, United States of America

Functional genomics of stress response, *Listeria monocytogenes*, *E. coli* O157, 7, STEC, gene expression, microarrays, Q-PCR, subtyping of pathogens, thermal inactivation of *Salmonella*, molecular methods for pathogen detection, chemical and physical pathogen inactivation methods, food antimicrobials and growth inhibition of *L. monocytogenes* on RTE foods, survival and adaptation of enteric pathogens in fresh produce and low moisture foods (wheat, flour).

Dr. Lindsey Beugoms, Ph.D.

Campbell Soup Company, Camden, New Jersey, United States of America

Escherichia coli, *Listeria monocytogenes*, *Salmonella*, *Enterococcus faecium*, low moisture foods (nuts, baked goods), low water activity foods, process validation, thermal inactivation, thermal processing (low acid and acidified canned foods), raw dough, wheat flour, fruit juice spoilage (*Alicyclobacillus*)



Professor Arun Bhunia, BVSc, PhD

Purdue University, West Lafayette, Indiana, United States of America

Immunological, cytotoxicity or cytopathogenicity assays, microbial pathogenesis, virulence, Microbiology, Probiotics

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Dr. Bledar Bisha, MS, PhD

University of Wyoming, Laramie, Wyoming, United States of America

Ecology of Foodborne Pathogens, Food Safety Microbiology, Rapid and Molecular Microbial Detection, Antimicrobial Resistance, Microbial Source Tracking, Single Cell Methods, Control of Foodborne

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Dr. Burton Blais

Bacterial foodborne

pathogens, detection, identification, characterization, molecular, genomics, immunoassay, PCR, WGS, method validation

Dr. Declan Bolton

Escherichia coli O157, 7 and non-O157 verocytotoxigenic Escherichia coli (STEC - ecology, epidemiology, transmission, virulence factors and control on the farm and during meat processing, Salmonella – epidemiology, pathogenicity, antibiotic resistance, stress response and gene expression, Campylobacter – epidemiology in poultry, pigs and humans, antibiotic resistance including the molecular basis of multiple resistances and on-farm and processing control including chemical decontamination, Yersinia enterocolitica and pigs, Clostridium estertheticum and Clostridium gasigenes and blown pack spoilage of vacuum packaged meat, beef, pork, lamb, poultry, broilers, fish, HACCP, prerequisites, GMP, GHP, biosecurity

Dr. Mick Bosilevac, PhD

USDA - ARS - US Meat Animal Research Center, Meat Safety and Quality Research Unit, Clay Center, Nebraska, United States of America

Beef, Pork, Lamb, Post-harvest intervention, Sanitation, E. coli O157, 7, Salmonella, Shiga toxin-producing E. coli (STEC), Listeria, Biofilm, Surrogate bacteria, PCR, Antigen detection, WGS, Metagenomics

Dr. Julie Brassard

Foodborne viruses in horticultural and animal production, Virus detection by concentration and molecular methods, Viral surrogates, Farm-to-table control strategies, Thermal and non-thermal virus inactivation strategies, Virome (NGS), Foodborne virus outbreaks



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ii, temperature, traceability

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Dr. Fred Breidt, PhD

USDA Agricultural Research Service, Raleigh, North Carolina, United States of America

Acid and general stress resistance in *E. coli*, *Salmonella* and *Listeria*, lactic acid bacteria, produce, fermented foods (kimchi, pickles, sauerkraut), preservatives, food spoilage, modeling of thermal and other inactivation kinetics, competitive exclusion

Dr. Robert I. Buchanan

Microbial food safety, Psychrotrophs, Predictive microbiology, Risk assessment, Microbiological criteria, HACCP, Molds/mycotoxins

Dr. Laurel Burall, Ph.D.

Center for Food Safety and Applied Nutrition, College Park, Maryland, United States of America

Persistence, environmental stress, listeriosis and *Listeria monocytogenes*, specifically looking into identification of contaminated foods and environmental samples and, enumeration of the levels of contamination to better inform risk analyses, environmental response, *L. monocytogenes* genomic diversity, pathogen detection, persistence, genomics, and transcriptomics



Professor Francis Butler, PhD

University College Dublin, Dublin, Ireland

Microbial quantitative risk assessment, Pathogens in the food chain, Next generation sequencing, Characterizing microbial distributions, Predictive microbiology, ,

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Professor Vasco A. P. Cadavez

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Professor Arzu Cagri-Mehmetoglu, PhD

Sakarya University, Sakarya, Turkey

Antimicrobial edible films and coatings, fungi, chitosan, biocontrol antimicrobial edible films and coating, antagonistic microorganisms as a biocontrol agent, and biosynthesized magnetic nanoparticles used to isolate pathogens from food products, antimicrobial properties of fungi chitosan from waste



Dr. Todd Callaway, PhD

University of Georgia, Athens, Georgia, United States of America

Cattle, Swine and poultry, Pre-harvest reduction strategies, Rumen/gut microflora, STEC, E. coli O157, 7, Salmonella, live animal interventions, Bacterial physiology, Microbial ecology

Dr. Lakshmikantha Channaiah

Ecology of antibiotic resistant bacteria, molds and mycotoxins, animal food safety, thermal validation of food process, bakery food safety, environmental monitoring and FDA FSMA regulations, process validation/ microbial challenge studies involving Shiga toxin producing *E. coli*, *Salmonella*, *Listeria monocytogenes*, and *Enterococcus faecalis*. Stored-product insects and its mitigation, food defense, post-harvest grain storage, molds and mycotoxins in grain supply chain, environmental monitoring, animal feed (now food) safety, and dairy microbiology

Dr. Travis Chapin

Produce safety, control of pathogens in in production, harvest, post-harvest storage, processing, innovative processing technologies, *Salmonella*, *E. coli*, *Listeria*, public health, water, water treatment, pre- and postharvest produce food safety and food safety education/outreach, fresh produce, hygiene, soil amendments, agricultural water, irrigation, FSMA, produce safety rule, GAPs, GMPs, preventive controls, fresh-cut, HACCP, education, outreach, workshops, *Salmonella*, *E. coli*, *Listeria*, *Cyclospora*

Dr. Ruplal Choudhary

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productions and filed work, antimicrobial interventions for fresh produce, poultry, seafood, beef and pork, process validations, HACCP, food safety regulations, policy

Dr. Faith Critzer, PhD

University of Georgia, Athens, Georgia, United States of America

Production and packaging of fruits/vegetables and risk mitigation strategies, *Listeria* in packinghouses, preharvest agricultural water treatments, validation of commercial produce sanitizers during produce washing, Good Agricultural Practices, RNAseq, transcriptomics, natural antimicrobials (essential oils), Gene expression profiles of *E. coli* O157, 7 and *Salmonella* (microarray and RT-PCR), non-thermal plasma inactivation strategies, novel antimicrobials, improved molecular detection of foodborne pathogens, and sampling/concentration of foodborne pathogens

Dr. Alexandre J. Da Silva, MSc, PhD. - FDA, USA

Polymerase chain reaction (PCR), Next generation sequencing (NGS), Molecular detection, Molecular assay, Immunological assay, Antibody, Water, Protozoa, Helminth, Parasite, DNA sequencing analysis, Microscopy, Surveillance, Outbreak, Epidemiology, Virus

Dr. Atin Datta, PhD

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, College Park, Maryland, United States of America

Bacterial genetics and physiology, *Listeria*, *E. coli*, *listeriosis*, bacterial stress response, antimicrobial susceptibility, molecular detection, gene expression, genomics, proteomics

Dr. Gordon R. Davidson, PhD

Center for Food Safety and Applied Nutrition, College Park, Maryland, United States of America

Tree nuts and tree nut environments, Pathogen transfer, Prevalence, Levels, Persistence, and mitigation strategies, *Salmonella*, *E. coli* O157, 7, Low moisture, Fresh-cut, produce, wash water, Chlorine, Peracid, Peroxyacetic acid, Cross- contamination

Dr. Heidi M. W. Den Besten

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Dr. Govindaraj Dev Kumar, PhD

University of Georgia College of Agricultural and Environmental Sciences - Griffin Campus, Griffin, Georgia, United States of America

E. coli, Salmonella, Listeria, STEC, antimicrobial resistance, sanitizers, antimicrobials, bacterial stress, gene manipulation, recombinant DNA technology, pathogenicity, survival, cross-contamination and control of foodborne bacterial pathogens in the environment, on produce, meats and in low moisture foods, bacterial physiology, bacterial genetics, environmental monitoring, biochemical/ immunological and molecular assays for detection and characterization of foodborne pathogens, Food Safety Microbiology

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Dr. Janak Dhakal, PhD

Lincoln University, Jefferson City, Missouri, United States of America

Salmonella, *E. coli*, Poultry processing, Post-harvest food safety, Biofilms, Thermal inactivation of pathogens, Environmental sampling, RTE foods, Antimicrobials (sodium hypochlorite, peroxyacetic acid, organic acids, medium chain fatty acids, sodium bisulfate, bacteriophage), Microbial pathogen mitigation in fats and oils, Mold (*Aspergillus flavus*, *Fusarium graminearum*), Animal feed, Control of molds using antimicrobials, Pet food, Challenge studies in food and animal feed, Conventional microbiological methods, PCR



Dr. Francisco Diez, PhD

University of Georgia Center for Food Safety, Griffin, Georgia, United States of America

Pre-harvest food safety, organic produce, Listeria, fresh Hispanic cheese, acid resistance and stress response, *Bacillus anthracis* inactivation, ecology of STEC, fresh produce, bacteriophages, colicinogenic *E. coli*, *Salmonella* in low moisture foods, Low water activity foods, wheat and wheat flour treatments *Clostridium difficile* in meats, plant-pathogen interaction, blue light treatment as antimicrobial intervention, *E. coli* O157, 7 in cattle

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Health Canada, Microbiology Research Division, Bureau of Microbial Hazards, Food Directorate, Ottawa, Ontario, Canada

Protozoan and helminth parasites – particularly the protozoans, *Cryptosporidium*, *Giardia*, *Cyclospora*, *Toxoplasma*, *Anisakis*, *Diphyllobothrium*, fish- and shellfish-borne trematodes, detection and molecular characterization using microscopy, flow cytometry, and PCR-based protocols, control in foods, viability and infectivity, zoonotic transmission of parasites

Dr. Melanie Downs, PhD

University of Nebraska-Lincoln, Lincoln, Nebraska, United States of America

Food allergen detection (ELISA, proteomic/mass spectrometric, LC-MS/MS, PCR), characterization, regulation, and management, effects of processing on food allergens, food proteomics

Dr. Vikrant Dutta, PhD

bioMerieux Inc Hazelwood, Hazelwood, Missouri, United States of America

Functional genomics, adaptive resistance in food processing environments (e.g., acid, disinfectants), microbial diagnostics, foodborne viruses, Next-Generation sequencing (NGS), and predictive modelling for source attribution, *Listeria*, *Salmonella*, *E. coli*

Dr. Gary Dykes

Biofilms, Bacterial attachment, Bacteria surface characteristics, Antibiotic resistance, Survival and stress response of *Salmonella*, *E. coli* O157, 7, STEC, *Campylobacter* and *Listeria* in fresh and processed meats, Role of antimicrobials and other compounds on bacterial surface characteristics, Lactic acid bacteria spoilage of meat, Pathogenic bacteria, Stress



Dr. Dennis D'Amico, PhD

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Dr. Mariem Ellouze

Modeling, Predictive microbiology, Microbial risk assessment and quantitative microbiology, Low moisture foods, Growth, Inactivation, *B. cereus*, *Listeria monocytogenes*, *S. aureus*, *Salmonella*



Dr. Andrea Etter, PhD

University of Vermont, Burlington, Vermont, United States of America

Listeria monocytogenes, *Salmonella*, poultry/poultry processing, retail delis, biofilms, sanitizer tolerance, heat tolerance, dairy, and genomics and transcriptomics for *Listeria and Salmonella*, ,

Dr. Ellen Evans

Consumer food safety research – behavior, Observation, Attitudes, Cognition, Training, and education

Professor Séamus Fanning

University College Dublin School of Public Health Physiotherapy and Sports Science, Dublin, Ireland

Emergence of antibiotic resistance and virulence in *Salmonella*, *E. coli* and *Campylobacter*, Application of WGS for risk assessment, Dairy microbiology, *Cronobacter* identification, Epidemiology, powdered infant formula, Low moisture foods, Molecular surveillance/sub-typing, Whole-genome sequencing, Zoonoses

Dr. (Yaohua) Betty Feng

Consumer food safety, education, survey, focus groups, Delphi method, Theory of Planned Behavior, Health Belief Model, health professional, low socioeconomic community, at-risk population, high school, curriculum development, program evaluation, ,

Dr. Edward Fox, PhD

Northumbria University, Newcastle Upon Tyne, United Kingdom

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Clemson University, Clemson, South Carolina, United States of America

Food safety education/training, Consumer and retail/foodservice interventions, Measurement of food safety knowledge/behavior/attitudes, Survey, Interview, and focus group methodologies

Dr. Pina M. Fratamico

Detection, Identification, Molecular characterization and subtyping of bacterial foodborne pathogens, Stress response, Virulence expression, Comparative genomics and proteomics, Quorum sensing in bacterial pathogens in food environments, Antibiotic resistance, Pathogenic *E. coli*, *Salmonella*, *Campylobacter*, *Listeria*

Dr. Venugopal Gangur, PhD

Michigan State University, Department of Food Science and Human Nutrition,

Allergens, Food allergens, Food allergy, Hypersensitivity disorders, Immunology, Immune function, Foods, and food components that modulate immune function, Allergy and asthma, Breast milk and immune function, Animal models of allergy/asthma, Immune function alteration by novel foods including genetically engineered foods, Immunotoxicology, Nutritional immunology



Dr. Santos Garcia, DSc

Autonomous University of Nuevo Leon, Faculty of Biological Sciences, San Nicolas de los Garza, Mexico

Physiology, epidemiology and control of foodborne pathogens, *Clostridium perfringens*, *E. coli*, *Campylobacter*, natural antimicrobials, mechanism of action, effect on growth and factors, antimicrobial resistance, microbial contamination of produce, microbial physiology

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Dr. Uta Gasanov, PhD

Sydney, Australia

Development of diagnostic tests for pathogens, Spoilage organisms and viruses

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Regulations

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Dr. Ifigenia Geornaras, PhD

Colorado State University, Fort Collins, Colorado, United States of America

E. coli O157, non-O157 Shiga toxin-producing E. coli (STEC), L. monocytogenes, Control, Antimicrobials, Decontamination treatments, Beef, Thermal inactivation in non-intact beef, Ready-to-eat meat and poultry products, Pre-harvest and post-harvest, Inoculum preparation, Prevalence of pathogens, Meat-associated spoilage and pathogenic bacteria, Salmonella, Poultry, Pork

Dr. Gregory Gharst

Campylobacter, Proficiency testing, Allergens, Peanut proteins



Assoc. Professor Efstathios (Stathis) Giaouris, PhD

University of the Aegean, Department of Food Science and Nutrition, Myrina, Greece

Bacterial attachment and biofilms, Microbial stress response, Microbial interactions, Quorum sensing, Disinfection, Fermented foods, Pathogen detection, Identification and quantification, Listeria, Salmonella, Lactococcus

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Dr. Kristen Gibson, PhD

University of Arkansas Division of Agriculture, Fayetteville, Arkansas, United States of America

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Dr. Leon Gorris, PhD

Nijmegen, Netherlands

Microbiological Food Safety, Food Safety Assurance, Food Safety Control, Food Safety Management Systems, Food Safety Management, food safety risk assessment, MRA, QMRA, qualitative MRA, quantitative MRA, MRA, predictive microbiology, risk assessment, risk management, risk communication, Food microbiology, Food safety

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Dr. Lisa Gorski

E. coli O157, 7, Salmonella, Campylobacter and Listeria monocytogenes, produce, plants, pre-harvest and food processing surfaces, inter-relatedness of bacterial species, ecological interactions, adaptation, biofilms, phenotypic characterization, genomic analyses, gene expression and regulation, cell surface biochemistry, soil microbiology, pathogen recovery/enrichment, real-time PCR

Dr. Sara Gragg, PhD

Kansas State University, Department of Grain Science & Industry, Manhattan, Kansas, United States of America

Salmonella, E. coli O157, 7, STEC, Pre-harvest transmission and intervention strategies, Cattle, Swine, Poultry (lymph nodes, feedlots), post-harvest processing of beef, pork, and poultry, pre-harvest and post-harvest safety of fresh produce (leafy greens)

Dr. Elizabeth Grasso, PhD

U.S. Food and Drug Administration, Bedford Park, Illinois, United States of America

Survival and thermal inactivation in low moisture/low water activity foods (nuts, spices, flours), Salmonella, E. coli, Listeria, Enterococcus faecium, growth, process validation, surrogates, cleaning and sanitizing low moisture facilities, extrusion, baking, microbial transfer, produce, dairy

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foods, Pre-harvest, Harvest, Post-harvest, Surrogates, Validation

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Dr. Arie Havelaar, PhD

University of Florida, Gainesville, Florida, United States of America

Risk assessment, Epidemiology of foodborne pathogens, Disease burden modeling

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Dr. Craig Hedberg, PhD

University of Minnesota Twin Cities School of Public Health, Minneapolis, Minnesota, United States of America

Public health surveillance for foodborne diseases, outbreak investigations, molecular serotyping systems, environmental factors associated with transmission of foodborne diseases

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Dr. Shauna Henley, PhD

University of Maryland Extension, College Park, Maryland, United States of America

Food safety outreach, education, and training (i.e. consumers, manufacturers, and farmers) for diverse audiences (geographically and racially/ethnically) and ages (youth to older adults), food safety interventions/programming development, implementation, adaptation, and evaluation. Behavior theory when applied to food safety education (e.g. Health belief model, adult learning theory, theory of planned behavior, etc.). Mixed-methods approaches to formative research and intervention/program evaluation (e.g. surveys, focus groups, and observational studies). Development of educational materials.

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Dr. Richard Holley

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Nonthermal processing methods (especially high hydrostatic pressure), Probiotic cultures (especially Bifidobacteria), Anaerobic bacteria (primarily clostridia), Predictive microbiology

Dr. Lijun Hu, PhD

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, College Park, Maryland, United States of America

Isolation and identification of bacteria, cultural and molecular detection of foodborne pathogens (such as Salmonella, Shiga toxin-producing Escherichia coli, Listeria), method development, method validation (e.g. LAMP, PCR, traditional method), serotyping, foodborne pathogen, antimicrobial resistance, virulence genes, protein structures of toxic gene products, national survey for foodborne pathogens, outbreak investigation, DNA sequencing, genomics, food products, such as eggs, spices, nuts, vegetables and fruits, animal feed, environmental samples, WGS (whole genome sequencing), Antimicrobial resistance (AMR)

Dr. Huisuo Sophi Huang

Antimicrobial, Antioxidant, Bio-protection, Ingredient application, Fermentation, Lactic acid bacteria, Meat and meat analogue, Pathogens, Spoilage



Assoc. Professor Kálmán Imre, PhD

Banat University of Agricultural Sciences and Veterinary Medicine Timisoara, Timișoara, Romania

Salmonella, *Listeria*, *Staphylococcus aureus*, *E. coli*, *Campylobacter*, PCR, antimicrobials, Antimicrobial Resistance, Microbial Molecular Biology, Bacterial Antibiotic Resistance, Molecular Bacteriology, Environmental Microbiology

Dr. Barbara Ingham

Salmonella, E. coli O157, 7, STEC, Listeria, Staphylococcus, beef, pork, and jerky, thermal and non-thermal processing validations, fresh and fresh-cut produce, washing, sanitizers, thermal processing of acidified/canned foods, fermentation of vegetables, consumer food safety education, ,

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Dr. Armita Jackson-Davis

Natural and organic food safety, Evaluation of natural antimicrobials, Biofilm formation, Microbial food safety and quality, Bacteriophage

Assist. Prof. Sanghyup Jeong, PhD

Michigan State University, Department of Biosystems and Agricultural Engineering, East Lansing, Michigan, United States of America

X-ray, irradiation, modeling, thermal inactivation, *Salmonella*, *E. coli* O157, 7, nuts, leafy greens, powders, low-moisture food, attachment, and spray drying, Developing nonthermal/thermal food safety intervention technologies, cleaning/sanitation of equipment and environment (low-moisture foods), microbial inactivation/growth modeling, and process optimization techniques to reduce the risk of foodborne disease, irradiation, low-moisture food safety

Dr. Zhen Jia, PhD

University of Florida, Gainesville, Florida, United States of America

pulsed electric field, superheated steam drying, biofilms, *Listeria*, *Salmonella*, *E. coli*, *Pseudomonas*, artificial intelligence (AI) to build innovation strategies for advancing microbial risk identification, predictive microbial risk analytics, and microbial risk assessment, biosensor, mathematical modeling, machine learning, rapid bacteria detection., Food safety, Food Microbiology, Food processing

Dr. Xiuping Jiang, PhD

Clemson University, Department of Food Nutrition and Packaging Sciences, Clemson, South Carolina, United States of America

Preharvest food safety, Animal waste, Composting, Organic fertilizer, Soil amendments, Fresh produce, Bacteriophage, Virus disinfection (norovirus, coronavirus), Rapid pathogen detection, Biological application of nanotechnology, Antibiotic resistance in commensal bacteria, *Helicobacter pylori*, *Clostridium difficile*, disinfection of surfaces

Dr. Yuqiao Jin, PhD

Illinois Institute of Technology, Chicago, Illinois, United States of America

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Dr. Jessica Jones, Ph.D.

Dauphin Island, United States of America

Subtyping, Sequencing, Seafood, Oyster, Whole genome sequencing, Shellfish, Vibrio spp., Real-time PCR, Molecular methods, Culture methods, Virulence assessment

Dr. Kieran Jordan

Teagasc Food Research Centre Moorepark, Moorepark, Ireland

Listeria, E. coli O157, 7, STEC, Stress, Persistence in processing environments including genetic basis, Inactivation/control using bacteriophage, Strain typing, PFGE, Dairy products, Chemical/drug residues, Milk quality

Dr. Snehal Joshi, PhD

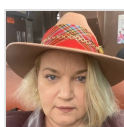
FRED HUTCHINSON CANCER CENTER, Seattle, Washington, United States of America

Food and environmental microbiology, virology, antimicrobial compounds, bacterial genomics, human microbiome, antimicrobials, next generation sequencing technologies, polyphenols, bacterial genomics

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Dr. Vijay K. Juneja

Meat and poultry microbiology, Predictive modeling, Microbial risk assessment, Thermal and non-thermal microbial inactivation, Escherichia coli O157, 7, Listeria monocytogenes, Salmonella, Clostridium perfringens, Clostridium botulinum, Heat resistance, D-value, z-value, Thermal destruction, Stress response, Heat shock, Cross protection, Predictive modeling, Minimally processed foods, Sous vide, Modified atmosphere packaging, Antimicrobials, Food preservatives, Spores



Ms. Robin Kalinowski, Master of Science, Microbiology

Tyson Foods Inc, Springdale, Arkansas, United States of America

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University of Delaware, Newark, Delaware, United States of America

Water, manure, viruses, bacteriophage, parasites, protozoa, helminthes, Cryptosporidium, Cyclospora, Toxoplasma, norovirus, hepatitis A virus, Tulane virus, murine norovirus, non-thermal processing of fruits and vegetables (high pressure processing, ozone, ultraviolet light), *E. coli*, *Salmonella*, PCR, real-time PCR, reverse-transcriptase PCR, parasite, environmental microbiology, irrigation water, wastewater, urban agriculture, controlled environmental agriculture, pre-harvest and produce food safety, *Salmonella*, pathogenic *E. coli* types, and *Listeria monocytogenes*

Professor Shigenobu Koseki, PhD

Hokkaido University, Sapporo, Japan

Predictive modeling of microbial survival by non-thermal processing, especially high-pressure processing, probabilistic modeling of microbial behavior (growth/survival) in foods, sanitization and preservation of fresh produce

Dr. Bala Kottapalli

Mathematical modeling, quantitative risk assessment, thermal and non-thermal inactivation of pathogens, growth and challenge studies, *Salmonella*, *L. monocytogenes*, *S. aureus*, *B. cereus*, HACCP implementation and management, low water activity foods, antimicrobials, ,

Dr. Jasna Kovac, PhD

The Pennsylvania State University, University Park, Pennsylvania, United States of America

Bacillus cereus group, *Campylobacter*, *Listeria*, *Salmonella*, Foodborne pathogens, Antimicrobial resistance, Virulence, Functional genomics, Whole genome sequencing, Metagenomics, Microbiomes

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Dr. Jovana Kovacevic, PhD

Oregon State University, Corvallis, Oregon, United States of America

Listeria spp., *L. monocytogenes*, Bacterial stress mechanisms, Antimicrobial resistance, Sanitizer effectiveness, Cleaning and sanitizing, Preventive controls, FSMA, RTE foods, Foodborne environmental pathogens, pathogen environmental monitoring, produce safety and contamination including on

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treatment), Food regulations, FSMA, Acidified and low-acid canned foods, Baking validations, Antimicrobial interventions, Post-harvest meat (acids, antimicrobials)

Dr. Allison C. Lacombe

Fresh produce, Blueberries, Almonds, Lettuce, Cranberry, Non-thermal inactivation including cold plasma, Irradiation, High intensity pulsed light, Norovirus, E. coli O157, 7, Salmonella, Listeria monocytogenes

Dr. Elisabetta Lambertini, PhD

Global Alliance for Improved Nutrition, Genève, Switzerland

Pathogen ecology, viruses, Salmonella, E. coli, predictive microbiology, zoonotic, food, water, irrigation, farm, virulence, sampling, qPCR, low water activity, spatial models, transfer, disinfection, preharvest and postharvest pathogen ecology in produce crops, farming practices, quantitative microbial risk assessment (QMRA), risk assessment, decision analysis, environmental fate and transport, exposure science, food safety, food systems

Dr. Keith A. Lampel

Methods of microbial detection in foods, Shigella, PCR methods, Microarrays, Molecular sequencing, WGS



Ing. Alexandre Leclercq, MSc

Institut Pasteur, Paris, France

Listeria, Yersinia, E. coli O157, Enterobacter (Cronobacter) sakazakii, Hepatitis A, Norovirus, Standardization, ISO, CEN, Method validation, MLVA, MLST, PFGE, PCR, Genomic, European regulation, Infant formula, Phage, Chromogenic media, CRISPR, Accreditation, Bioterrorism

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Dr. Hyun Jung Lee

Toxicity evaluation and mechanisms using cell cultures and animal models, Toxin detection using HPLC and LC-MS, Bioconversion (fermentation) using microorganisms and enzymes

Assoc. Professor Xinhui Li, PhD

University of Wisconsin-La Crosse, Department of Microbiology, La Crosse, Wisconsin, United States of America

Antibiotic resistance, lactic acid bacteria, food fermentation, foodborne virus, norovirus, high pressure processing

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Assist. Prof. Alexandra Lianou, PhD

University of Patras, Patra, Greece

Foodborne pathogens, Salmonella enterica, Listeria monocytogenes, Staphylococcus aureus, strain variability, quantitative microbiology, predictive modelling, microbial interactions, biofilms, lactic acid bacteria, Bacteriocins, biopreservation, microbial biotechnology

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Dr. Girvin Liggans, PhD

US Food and Drug Administration, Silver Spring, Maryland, United States of America

Retail food safety, Consumer studies, Organizational behavior, Legal epidemiology, and policy analysis, Surveys, Attitudes and behaviors

Dr. Denise Lindsay, PhD

Fonterra Research and Development Centre, Palmerston North, New Zealand

Dairy microbiology, Environmental sampling for bacteria, Foodborne pathogens especially dairy-associated, Bacterial biofilms, Sanitiser susceptibility studies - biofilms, Source attribution of pathogens in food manufacturing plant

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Dr. Aurelio López-Malo, Dr

University of the Americas Puebla, San Andrés Cholula, Mexico

Predictive microbiology, predictive model generation and validation, antimicrobial agents including naturally occurring agents, emerging technologies including high pressure, high frequency ultrasound, short-wave ultraviolet light, and microwave heating, hurdle technologies, fungal ecology, fruit processing, hurdle technology, modified atmosphere packaging, edible films, microbial stress factors (pH, water activity, antimicrobials).

Dr. Marciane Magnani

Stress response, foodborne pathogens, essential oils, biofilm, natural antimicrobials, agro-industrial byproducts, antimicrobial resistance, prebiotics, probiotics, lactic acid bacteria, *Salmonella*, *E. coli*

Dr. Kudakwashe Magwedere

Biosecurity, Food safety management systems, Food policy and regulations, Safety and hygiene of meat, *Listeria*, *Salmonella*, *E. coli*, Animal health, Veterinary medicine, ,

Dr. Andrea Mc Whorter, PhD

The University of Adelaide School of Animal and Veterinary Sciences, Adelaide, Australia

Salmonella, *Campylobacter*, eggs, raw egg-based food, poultry meat, chicken meat, sanitizers, WGS, gene expression, cell culture, bacterial virulence, ,

Dr. Jennifer Mcentire

Fresh produce safety, Preventive controls, and foreign supplier verification, food traceability, food defense, food fraud, *Listeria monocytogenes*, *Cyclospora*, wash water, environmental monitoring

Dr. Jeanne-Marie Membré, PhD

National Research Institute for Agriculture Food and Environment Pays de la Loire Center, Nantes, France

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The University of Maryland, College Park, Maryland, United States of America

Human pathogen-plant interactions, Plant colonization, Rhizosphere, Phyllosphere, Plant microbiomes, Salmonella on produce, Crop production practices, Irrigation water quality, Biocontrol, Farm management practices, Antibiotic resistance in the environment

Dr. Marlee Mims

Seafood, seafood decomposition/spoilage, histamine/scombrototoxin fish poisoning, histamine producing bacteria, food microbiology, food safety, aquaculture, ,

Dr. Udit Minocha

Ready-to-eat, *Listeria*, *Salmonella*, *Clostridium*, spore, germination, sporulation, nitrate, nitrite, nitrate-reduction, inoculation pack studies, process deviation, salting, case-hardening, heating deviation, cooling deviation, surrogate, antimicrobial, food contact surface, environmental, biofilm, harborage, cross contamination, canning, modeling, microbiological modeling, pathogen modeling, fermentation, eggs, pasteurization, plate chiller, antimicrobials on food (organic acids, peroxy acids), antimicrobials on environmental/food contact surfaces (organic and inorganic compounds), lactic acid bacteria (fermented meats) or bacteriophage (on meat and as environmental disinfectants), RTE, salt-cured products, control of *Salmonella*, *Listeria*, STEC in RTE by either bacteriocins or phages on RTE or raw meat and poultry, HACCP system/Hazard Analysis, Challenge testing/inoculated pack studies, Process validations



Dr. Abhinav Mishra, PhD

University of Georgia, Athens, Georgia, United States of America

Ready-to-eat, *Listeria*, *Salmonella*, *Clostridium*, spore, germination, sporulation, nitrate, nitrite, nitrate-reduction, inoculation pack studies, process deviation, salting, case-hardening, heating deviation, cooling deviation, surrogate, antimicrobial, food contact surface, environmental, biofilm, harborage, cross contamination, canning, modeling, microbiological modeling, pathogen modeling, fermentation, eggs, pasteurization, plate chiller, antimicrobials on food (organic acids, peroxy acids), antimicrobials on environmental/food contact surfaces (organic and inorganic compounds), lactic

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Dr. Dragan Momenovic

Transmissible spongiform encephalopathies (TSEs), Detection of animal proteins in feed, Detection of central nervous system tissue in food, Risk analysis of TSE-related issues, rendering animal products, inactivation of TSE agents in food/feed, use of new animal drugs in animal feed, nanotechnology applications for food



Dr. Matthew Moore, PhD

University of Massachusetts Amherst, Department of Food Science, Amherst, Massachusetts, United States of America

Food microbiology, Food and environmental virology, Norovirus, eukaryotic virus-bacteria interactions, Gut microbiome, Portable detection and sequencing platforms, Viral inactivation strategies and therapeutics, Viral concentration techniques, Microbiome, Mycotoxin, Biosensor

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Dr. Huda Neetoo, PhD

University of Mauritius, Reduit, Mauritius

Fresh produce, sprouts, poultry, histamine, thermal and non-thermal processing (high pressure), antimicrobials, nisin, packaging, *Listeria*, *Salmonella*, *E. coli*, *Vibrio*, *norovirus*, food and water microbiology, food processing, climate change and food safety, mycotoxins, histamine, seafood

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Dr. Brendan Niemira

Food irradiation, Cold plasma technology, High-intensity pulsed light, Microbial ecology of foods and food-contact surfaces, Biofilms, Persistence, Antimicrobial interventions, CSLM and digital image analysis, Non-thermal processes, Fresh and fresh-cut fruits and vegetables, Plant pathology and physiology

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Dr. John Novak, PhD

New York City, Department of Health and Mental Hygiene, New York, New York, United States of America

Foodborne pathogen isolation and detection, *Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus*, *Vibriobacteria*, *E. coli* O157:H7, *Salmonella*, *Shigella*, *Listeria monocytogenes*, *Campylobacter jejuni*

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Professor George -John Nychas, PhD

Agricultural University of Athens, Athens, Greece

Food spoilage (meat, fish, vegetables), indicators of quality and safety, Natural antimicrobial, Rapid methods in food microbiology, MAP technology of meat, fish and vegetables, Microbial ecology of foods, growth/survival (modeling) of pathogens, emerging pathogens, stress response food microbiology

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Dr. Stanley T. Omaye, PhD

University of Nevada Reno, Department of Agriculture Nutrition and Veterinary Sciences, Reno, Nevada, United States of America

Heavy metals, Antioxidant and pro-oxidants, Lipid oxidation, Nutrient toxicity, Nutrient-toxicant interactions, Functional foods, Phytochemicals, Safety testing of food ingredients, Supplement safety, Toxicology

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Assoc. Professor Ynés R. Ortega, PhD

University of Georgia Center for Food Safety, Griffin, Georgia, United States of America

Parasites (protozoa, helminths, ectoparasites), Parasitic and zoonotic infections, pre-and post-harvest, chemical sanitizers, *Salmonella*, *E. coli* (STEC), epidemiological investigations

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Dr. Jeffrey Palumbo

Mycotoxins (aflatoxin, ochratoxin and fumonisin), *Aspergillus*, *Listeria*, Microbe-microbe interactions, Biocontrol control, Soil ecology, Molecular ecology



Professor Efstathios Panagou, PhD

Agricultural University of Athens, Athens, Greece

Lactic acid bacteria, fermentation, olives, meat spoilage, fresh produce, Raman and FT-IR spectroscopy, electronic nose, grapes, mycotoxins, *Listeria*, *Salmonella*, molds, *Aspergillus*, fungal ecology, machine learning, vibrational spectroscopy, food quality, predictive mycology, fermented foods

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Dr. Rakhi Panda, PhD

US Food and Drug Administration, Silver Spring, Maryland, United States of America

Food allergy, Gluten, Immunoassays, Detection and quantitation, Allergenicity assessment, Food processing, Fermented and hydrolyzed foods

Dr. Ashish Pandit

Milk, Cheese, Dry powders, and juice processing, Environmental pathogens control in food manufacturing, Antimicrobial wash in RTE foods, CIP automation, Spoilage control, and shelf life extension

Dr. Konstantintos Papamimitriou

Lactic acid bacteria, Next generation sequencing, Genomics, Metagenomics, Microbial stress, Bacteriocins, Probiotics, Genetic manipulation, Bioinformatics, Starter cultures, Fermentation, Milk, Cheese

Dr. Mickey Parish

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Professor Salina Parveen, PhD

University of Maryland Eastern Shore, Princess Anne, Maryland, United States of America

poultry, meat, fresh produce, *Vibrio*, *Salmonella*, *Listeria*, STEC, bacterial source tracking, antimicrobial resistance, pathogenicity, genomics, metagenomics, rapid molecular detection, predictive modeling, Environmental Microbiology, and Water Quality, poultry, Application of genotypic and phenotypic methods for tracking sources of food- and water- borne pathogens in food processing plants and in aquatic environments, Development and application of rapid molecular and immunological methods for detection of water- and food -borne pathogens, genomics, metagenomics, Bacterial source tracking, indicator organism, Seafood, vibrio, salmonella, antibiotic resistance, environmental microbiology, water quality

[> View full biography](#)**Professor Michael W. Peck**

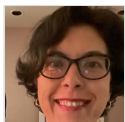
Norwich Research Park, Colney , Norwich, United Kingdom

Clostridium botulinum, Botulinum neurotoxin, Minimally processed refrigerated foods, *Bacillus* and *Clostridium* spores

Professor Fernando Pérez-Rodríguez, PhD

University of Cordoba, Department of Food Science and Technology, Córdoba, Spain

Predictive microbiology, Predictive software, Next generation sequencing (NGS), Metagenomics, Quantitative risk assessment, Antimicrobial resistance, Microbial food safety and quality, Bioprotection

**Dr. Monica Ponder, PhD**

Virginia Polytechnic Institute and State University, Blacksburg, Virginia, United States of America

Salmonella inactivation in low moisture foods, Steam, Ethylene oxide, Role of pathogen stress on virulence, , , low water activity foods, antibiotic resistant bacteria in foods, microbial ecology of foods

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[artificial intelligence and machine learning (AI/ML)], supply chain and system modeling, food safety engineering, and molecular epidemiology

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Dr. Rajeev Prasad

Poultry, Veterinary medicine, Pre-harvest, Salmonella, Campylobacter, E. coli, Clostridium perfringens, Brucella, Poultry viruses, Vaccines

Dr. Jennifer J. Quinlan, PhD

Drexel University, Philadelphia, Pennsylvania, United States of America

Consumer education, Consumer handling, Food handling behavior, Retail food safety, Behavior change, Salmonella and poultry, Minority consumers, at risk populations, Microbiological analysis, Poultry, Interdisciplinary/translational research, Focus groups, Surveys

Professor Kalliopi Rantsiou, PhD

University of Turin, Torino, Italy

Food fermentation, Wine, Sausage, Yeasts, Lactic acid bacteria, PCR, Next generation sequencing, Amplicon sequencing, Metagenomics, Transcriptomics, Fecal microbiota, foodborne pathogens, microbial ecology, food microbiota

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Dr. Benjamin Redan

Heavy metals, ICP-MS, lead, cadmium, mercury, arsenic speciation, LC-MS, chemical contaminants, analysis of heavy metals (toxic elements) in foods, studies on thermal inactivation of small molecule chemical/process contaminants, and novel methods for quantifying contaminants in foods and beverages, ICP-MS, lead, cadmium, mercury, arsenic speciation, LC-MS, process contaminants



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Dr. David Rodriguez-Lazaro

Antimicrobial resistance, Molecular detection of enteric viruses (Hepatitis E) and foodborne pathogens (Listeria), epidemiology and control of Listeria, genomics, microbiome, NGS/WGS sequencing, risk assessment

Dr. Dojin Ryu, PhD

University of Idaho, Moscow, Idaho, United States of America

Molds and mycotoxins including occurrence, impact of postharvest processing/treatment, toxicology, and risk assessment, mycotoxin detection including HPLC and ELISA, food safety education



Prof. Dr. Anderson Sant'Ana, PhD

UNICAMP - University of Campinas, SAO PAULO, Brazil

Predictive microbiology, predictive modeling, risk analysis, quantitative microbial risk assessment, challenge tests, foodborne pathogens (Salmonella, Listeria, Bacillus cereus, Clostridium perfringens, Clostridium botulinum), probiotics, spoilage microorganisms (Alicyclobacillus, Clostridium, Bacillus, fungi), effects of processing on the microbial quality and safety of foods, GC-MS, HPLC, MS-MS and molecular tools

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Dr. Charles Santerre, PhD

Clemson University, Clemson, South Carolina, United States of America

Food toxicology (mercury, trace elements, PCBs, PBDE's, among others in seafood), Measurement and bioavailability, Seafood safety, Bisphenol A in packaging, Pesticide analytical methods including SPME, GC/MS, ELISA, effects of cooking on chemical contaminants, Melamine, Risk assessment, Ag Policy

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contaminants in foods and risk benefit assessment when looking at dietary patterns, Cadmium, risk-benefit assessment

Dr. Yelena Sapozhnikova

Analysis of organic chemical contaminants using Liquid Chromatography-Mass Spectrometry, Gas Chromatography-Mass Spectrometry, Accelerated solvent extraction, Gel permeation chromatography, QuEChERS, method development research, analysis of pesticides, Persistent organic pollutants (POPs) and organic environmental contaminants



Dr. Elenora Sarno, PhD

Parma, Italy

Meat hygiene, epidemiology of foodborne pathogens, antimicrobial resistance, foodborne outbreak investigations, risk assessment, E. coli, Campylobacter, Yersinia, HACCP, foodborne outbreak assessment, listeria, one health, salmonella, vibrio, food hygiene

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Dr. Don W. Schaffner

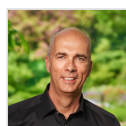
Predictive food microbiology, quantitative microbial risk assessment, cross-contamination, handwashing, bacterial transfer, cross-contamination, challenge testing, fresh produce, dried and low water activity foods, restaurants and food service, *Salmonella*, *norovirus*, *Listeria*, *E. coli*, *Clostridium botulinum and perfringens*, *Staphylococcus aureus*, HACCP

Dr. Robert Scharff, PhD

The Ohio State University, Columbus, Ohio, United States of America

Economics of foodborne illness, Consumer Economics, Illness Attribution, Benefit Cost Analysis

Dr. Kristin Schill, PhD

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Dr. Herbert Schmidt, PhD

University of Hohenheim, Stuttgart, Germany

Pathogenic E. coli, STEC, PCR detection, Pathogenicity islands, Toxins, Recombinant protein expression, Shiga toxin-encoding bacteriophages, Subtilase, DNA sequencing, Bacteriophages, EHEC, Shiga toxin

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Dr. Keith Schneider

E. coli, Salmonella, Shigella, Fresh produce (lettuce, tomatoes), Packinghouses, Soil amendments, Aquaculture

Dr. Harry Schonberger, PhD

Virginia Polytechnic Institute and State University, Blacksburg, Virginia, United States of America

Food safety education, Farms/farmers, Farmers markets, Cooperative extension, Qualitative methods, Food donation, Food recovery, produce safety, food handler observational studies, surveys, and focus groups, consumer behavior, food preservation, Retail food handling, Cooperative Extension volunteers



Dr. Heidi Schwartz-Zimmermann, PhD

University of Natural Resources and Life Sciences Vienna, Wien, Austria

Mycotoxins, Mycotoxin biomarkers, HPLC, Mass spectrometry Mycotoxins and mycotoxin biomarkers, Metabolomics

Dr. Kun-Ho Seo

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Food engineering, Thermal and non-thermal food processing and preservation technologies, Dairy products, Food shelf-life, Food quality attributes, Functional properties, Physical properties, Modeling process optimization, Probiotics, Prebiotics, Lactic acid bacteria , ,

Dr. Manan Sharma

E. coli O157, 7 survival in leafy greens, produce, soil, manure, compost, and irrigation water, impact of modified atmosphere packaging on *E. coli* virulence, stress response (*rpoS*) of *E. coli* and *Salmonella* on leafy greens, sand filters and zero-valent iron for recovery of *E. coli* and *Salmonella* from irrigation water, shiga-toxin and other virulence factors in EHEC, virulence factors, lytic bacteriophages for control of foodborne pathogens in lettuce and melons, adaptation of enteric pathogens to non-host environmental conditions, Produce safety Soil amendments, Manure, Heat treated poultry pellets, Water filtration

Assoc. Professor Cangliang Shen, PhD

West Virginia University Division of Animal and Nutritional Sciences, Morgantown, West Virginia, United States of America

Natural antimicrobials (hops), *Enterococcus*, *Salmonella*, *Campylobacter*, *Listeria*, sanitizers for poultry, eggs and fresh produce, stress adaptation, farm market safety, postharvest sanitizing procedures for reducing food safety risks on poultry meat products and fresh produce, which including thermal and or nonthermal process, antimicrobial treatments and outreach related survey studies in very small to small local communities, thermal inactivation, egg, surrogate bacteria, extension survey.

Dr. Ellen Shumaker, PhD

NC State University, Raleigh, North Carolina, United States of America

Food safety education and training (consumers, food handlers), food safety risk communication and messaging, safe food handling knowledge, attitudes, and behaviors, food safety culture, survey and observational research, mixed methods research, observation, consumer behavior, risk communication, kitchens



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Dr. Sujata Sirsat, PhD

University of Houston, Houston, Texas, United States of America

Food safety education, Food safety training, Food safety observations, Restaurant food safety, Retail food safety, Farmers market food safety, Controlled environmental agriculture, Produce safety, Agriculture, Food safety disparities, Beer safety and quality, Cross contamination, pre and post-harvest safety, Hydroponics, Controlled environmental agriculture, Food safety disparities, ,

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Dr. Derike Smiley, PhD

US Food and Drug Administration, Jefferson, Arkansas, United States of America

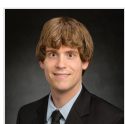
Listeria monocytogenes, Salmonella, Clostridium, method validation, PCR, molecular biology, antibody, ELISA, ELFA, immuno-fluorescence, regulatory, enrichment, antibody capture, immuno-magnetic, foodborne pathogens, analytical microbiology, bacterial recovery, bacterial detection, aptamers, sequencing

Dr. Abigail Snyder

Wet and dry sanitation, mold, food spoilage, fungal spoilage, process validation, bacteriocins, fruit, juice, *E. coli*, food safety training, microbial genomics

Dr. Yoonseok Song

Package integrity, Active packaging, Inspection, and testing, Chemical migration of indirect food additives/contaminants/degradation products, plastics, indirect additives, recycling, active, ,



Dr. Matthew Stasiewicz, PhD

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Professor Roger Stephan, DVM

University of Zurich Institute for Food Safety and Hygiene, Zurich, Switzerland

Bacterial foodborne pathogens (ecology and epidemiology, strain characteristics, virulence, WGS, stress response, molecular methods for rapid detection and identification), *Salmonella*, STEC, *Cronobacter* spp., *Listeria monocytogenes*, *S. aureus*, health hazards and microbiological monitoring systems in the slaughtering process, antibiotic resistance in meat and dairy products, ,

Dr. Laura Strawn

Salmonella, *Listeria*, produce safety, Persistence, Diversity, Pre-harvest, Ppost-harvest, GAPs, HACCP, Pathogen environmental monitoring programs, PFGE, Geographic Information Systems (GIS)



Dr. Silin Tang, PhD

MARS Global Food Safety Center, Beijing, China

Whole genome sequencing (WGS), foodborne pathogen detection and identification, subtyping, serotyping, pathogen source tracking, antimicrobial resistance, stress response, transcriptomics, *Salmonella*, *Listeria monocytogenes*, nanopore sequencing, antimicrobials, metagenomics, SNP analysis, MLST analysis, serotype prediction, CRISPR

Dr. T. Matthew Taylor

Chemical preservatives, natural antimicrobials, lactic acid bacteria-derived competitive cultures and biocontrol, antimicrobial mechanisms for bacteriocins and organic acids in processed meat and poultry products, nano-scale technologies for encapsulating food antimicrobials, development of biosensor technologies, safety of fresh and minimally processed produce

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contamination, transfer, consumer food handling practices, fruits, vegetables, meat, poultry, deli meat, dairy, bacteriocins

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Dr. Ewen Todd, PhD

Michigan State University, East Lansing, Michigan, United States of America

Foodborne disease statistics and summary data, factors contributing to outbreaks, seafood toxins, Food Safety

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Dr. William (Woody) H. Tolleson

Protein chemistry, Microcalorimetry, Ribosome-inactivating protein toxins, Ricin, Abrin, Shiga-like toxins, Staphylococcal enterotoxins, fumonisin B1, isoflavones, genistein, daidzein, biochanin A, formononetin, phase I metabolism, cytochromes P450, thermodynamics, Gene expression, microRNA, pyrrolizidine alkaloids, melamine, fumonisin B1, retinoic acid, photobiology and photochemistry, differential scanning calorimetry, protein stability, isothermal titration calorimetry, reaction kinetics, cytotoxicity, chemical carcinogenesis



Mr. David Tomas Fornes, MsSc

Merck España, Madrid, Spain

Development, standardization and validation of reference and alternative microbiological methods, new analytical technologies, spoilage microorganisms, pathogens, molecular biology, method validation, culture media, molecular methods, PCR, sample preparation, ISO methods, microbiological analysis, pathogen, spoilage microorganisms, hygiene indicators

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Technical University of Denmark, Lyngby, Denmark

Hygiene in food processing environments, water and environmental hygiene, biofilms, *Listeria monocytogenes*, fish, seafood, antibiotic resistance, microbial survival in food systems, food preservation, food spoilage, cleaning and disinfection, microbial source tracking, molecular methods



Professor Mark Turner, PhD

University of Queensland, Brisbane, Queensland, Australia

Dairy microbiology, fermentation, probiotic lactic acid bacteria including *Lactococcus* and *Lactobacillus* - genetics, genomics, antimicrobials and applications, spore-forming bacteria - *Bacillus* and *Geobacillus* molecular detection and genotyping, biocontrol applications in foods, pathogen control in produce, fungal control in dairy, biocontrol, probiotics

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Professor Vasilis P. Valdramidis, PhD

National and Kapodistrian University of Athens, Department of Chemistry, Athens, Greece

Air filtration, Cold atmospheric plasma, Decontamination, High power ultrasound, Nanoparticles, predictive microbiology, Predictive modeling, Shelf-life, Model-based optimization of thermal and non-thermal technologies, Antifungal compounds for post-harvesting preservation

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Dr. Antonio Valero-Díaz, PhD

University of Cordoba, Department of Food Science and Technology, Córdoba, Spain

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Dr. Jun Wang, PhD

Qingdao Agricultural University, Qingdao, China

Microbial risk assessment, predictive microbiology, bacteriophage, atmospheric cold plasma, plasma-activated water, electrolyzed water, UVC-LEDs, non-thermal sterilization, dairy and meat product, biofilms, mathematical modeling, RT-PCR, LAMP



Dr. Siyun Wang, PhD

The University of British Columbia, Faculty of Land and Food Systems, Vancouver, British Columbia, Canada

E. coli, *Listeria monocytogenes*, *Salmonella*, bacteriophage, fresh produce, poultry, dairy, genomics, transcriptomics, microbiome

Dr. Zhengfang Wang

Chemometrics, modeling, LC-MS, GC-MS, ICP-MS, EMA, VOC, seafood, economically motivated adulteration (EMA), food fraud, volatile organic compounds (VOC), heavy metals, pesticides, animal drugs, mycotoxins, and seafood decomposition



Professor Keith Warriner, PhD

University of Guelph, Department of Food Science, Guelph, Ontario, Canada

Microbiological safety of minimally processed vegetables (alfalfa sprouts, tomatoes), interaction of human pathogens with vegetables, non-thermal intervention technologies (UV, biocontrol, bacteriophages), produce sanitizers, HACCP, pathogen diagnostics (biosensors, immunoassays), microbial source tracking (DNA typing)

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The Pennsylvania State University, University Park, Pennsylvania, United States of America

Mycology, Yeast, Mold, Mycotoxins (aflatoxin), Fungal genomics, fermentation, food safety

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Dr. Alissa Wesche

Juice processing and juice safety, HACCP, GMPs, Thermal processing, Patulin and Alicyclobacillus, Heavy metals (lead, arsenic), Organic processing, Sublethal injury, ingredient safety



Professor Martin Wiedmann, PhD

Cornell University, Ithaca, New York, United States of America

Listeria, dairy food safety and quality, pre-harvest food safety, molecular subtyping and detection methods, epidemiology and pathogenesis of foodborne diseases, Salmonella, whole genome sequencing (WGS), dairy microbiology, environmental monitoring, Microbial food spoilage

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Dr. Helen Withers, PhD

Wellington, New Zealand

Red meat, poultry, pre-harvest, post-harvest, retail, food-processing environments, meat spoilage, *Listeria*, STEC, *Escherichia coli*, O157, *Salmonella*, *Campylobacter*, *Clostridium*, molecular detection methods, whole genome sequencing (WGS and NGS), PCR detection, metagenomics, microbiological method development, epidemiology, food regulations, Molecular Microbiology, food safety

Dr. Charlene E. Wolf-Hall, PhD

South Dakota State University, Brookings, South Dakota, United States of America

Mycology, mycotoxins, trichothecenes, deoxynivalenol, zearalenone, aflatoxin, ochratoxin, *Fusarium*, *Aspergillus*, *Penicillium*, grain, cereals, microbial loads, grain, wheat, barley, flour, malt, grain microbiology, mushroom production, grain microbiology, ,

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Dr. Xianqin Yang, PhD

Lacombe Research and Development Centre, Lacombe, Alberta, Canada

Antimicrobial interventions, Shiga toxin-producing E. coli, Salmonella, Meat processing environments, Tracking and control of contamination, Mechanisms for survival and persistence, Microbial quality

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Dr. Yishan Yang, PhD

USDA-ARS Beltsville Agricultural Research Center, Beltsville, Maryland, United States of America

thermal and nonthermal processing, egg safety, microbial inactivation, fresh produce safety and quality, shelf-life, bacterial stress response, biofilm formation and elimination

Dr. Ian Young, PhD

Toronto Metropolitan University School of Occupational and Public Health, Toronto, Ontario, Canada

epidemiology, survey and observational research, food safety education and training, mixed-methods research, knowledge synthesis, food inspection, food-borne illness surveillance and prevention, public health, food safety policy, applied statistical modelling, Bayesian analysis, One Health

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Dr. Me Yu

E. coli O1567, 7, Murine norovirus, Salmonella, Vibrio, Listeria, non-thermal processing (pulsed light, high hydrostatic pressure), fresh produce (berries), fish and seafood (oysters), natural antimicrobials, chitosan



Assoc. Professor Hyun-Gyun Yuk, PhD

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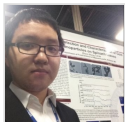
Dr. Guodong Zhang, PhD

US Food and Drug Administration Biosciences Library, Silver Spring, Maryland, United States of America

Salmonella, Listeria, E. coli, Shigella, Campylobacter, Mycobacterium, isolation, detection, PCR identification, typing whole genome sequencing (WGS), methods development and validation, chromogenic media, produce (leafy green, melon, tomato, pepper), peanuts, poultry, beef, dairy (cheese and raw milk), eggs, manure, dry ingredients, spices, crops (soybeans, wheat, and maize), sanitary design, deli meat slicers, aerosols, probiotics, prebiotics, antimicrobials, FSMA, outbreaks

Dr. Yifan Zhang

Antibiotic resistance, molecular epidemiology of *Listeria*, *Staphylococcus*, MRSA, plant antimicrobials, bacteriophage-mediated control and detection, novel pathogen control strategies, fresh produce safety, environmental contamination, horizontal gene transfer, microbial contamination in food and agricultural settings, horizontal gene transfer



Dr. Zhiyun Zhang, Ph.D.

Daisy Brand, Dallas, Texas, United States of America

Assessment of microbial metabolites (NMR, LC-MS), Spectroscopy, including Raman/FT-IR/X-ray Fluorescence (XRF), to detect and quantify, Pesticide (e.g., thiabendazole, fipronil) and antibiotics (Aminoglycosides) residues, Toxic metal elements (e.g., inorganic arsenic, selenium, and cadmium), Pathogenic bacteria (e.g., Salmonella, Listeria) and Emerging Nano-contaminants (silver and titanium dioxide nanoparticles) in agricultural and dairy systems, emerging contaminants., ,

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Dr. Meijun Zhu

Listeria monocytogenes, Salmonella, apples, low-moisture foods, produce, intervention

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response, microbial modelling, risk analyses, risk assessment, sampling plans, dose-response, food safety management, exposure assessment, quantitative microbiology

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Phenotypic and Genotypic Characterization of *Salmonella* Isolates Recovered from Foods Linked to Human Salmonellosis Outbreaks in Minas Gerais State, Brazil

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Food Traceability Systems, Consumers' Risk Perception, and Purchase Intention: Evidence from the “4-label-1-Q” Approach in Taiwan

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Influence of Free Chlorine and Contact Time on the Reduction of *Salmonella* Cross-Contamination of Tomatoes in a Model Flume System

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Food Traceability Systems, Consumers' Risk Perception, and Purchase Intention: Evidence from the “4-label-1-Q” Approach in Taiwan

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ABSTRACT

Many food safety issues have arisen in Taiwan during the past decade. Therefore, in 2016, the Taiwan government proposed the “five rings of food safety” policy to comprehensively protect consumer food supply. Among these policies, the “4-labels-1-Q” approach was adopted to ensure the selection of foods with traceable labels for retrospective study. Hence, this study investigated the association between the degree of familiarity with the 4-labels-1-Q food traceability system and risk perceptions and also investigated whether a consumer's purchase intention toward fresh foods with food labels changed after viewing an educational film on food labels. This study defined subjects as the main food purchasers for their families; 290 valid questionnaire interviews were administered and educational films shown in Tainan markets and stores. Results showed that knowledge about labels significantly affected risk perception for labeling. Age, educational level, and degree of risk perception influenced purchase intention. Results also showed that after viewing the video, subjects' label knowledge and purchase intention increased significantly. However, after adjustment for age, educational level, income, and purchase places, the effect of film education on risk perception was insignificant, especially for those who had lower educational levels, including those older than 65 years. Public trust can be boosted through label education among age groups using different channels and methods, and encouraging the sale of labeled foods in traditional markets would be a useful strategy. Age, educational level, income, and risk perception of participants significantly affected purchase intention. This study can be a reference for designing risk communication strategies and promoting traceable agricultural products.

HIGHLIGHTS

- Knowledge about labels significantly affected the risk perception for labeling.
- Understanding labeling had a slight effect on participants' risk perceptions.
- Risk perception influenced purchase intention.
- Label knowledge and purchase intentions increased after film education.
- Education about labeling is needed to improve trust in the elderly.

Key words: Food label; Food safety; Food traceability system; Purchase intention; Risk perception

Over the past few years, as many countries have faced food safety issues, they have started to establish their own food traceability systems. France implemented food registration in 1969 and established a food traceability system in 1998. Likewise, the United Kingdom established a food traceability system in 1996, following the outbreak of bovine spongiform encephalopathy (mad cow disease). Additionally, the European Union published the European Commission's White Paper on Food Safety in 2002, which specified that information should be made available from upstream to downstream. They also specified that raw

materials should be provided within 4 h of occurrence during any food safety incident (25).

Taiwan has had many food safety issues in the past decade, such as contamination with phthalate plasticizers or with fuels derived from agricultural waste, e.g., from oil meals and waste cooking oils (5, 46, 48). As a result, the Food and Drug Administration, Taiwan (FDA Taiwan) and food safety experts made several legislative amendments, thereby strengthening public understanding of basic food safety concepts. To improve food safety management methods and establish consumer confidence, the government of Taiwan proposed the “five rings of food safety” policy in June 2016, which focused on (i) exercising control at the source; (ii) reestablishing production management

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histories; (iii) boosting the government's inspection capabilities; (iv) imposing heavier responsibilities on producers and manufacturers; and (v) encouraging and creating oversight platforms. This policy ensured that every step, from farm to table, meets environmental and safety standards.

To address the second strategy in Taiwan's five rings of food safety policy ("re-establish production management histories") preferential selection of foods with traceable labels has been promoted in children's lunches since 2016. This policy encourages schools to select foods with traceable labels for retrospective study, those that meet the requirements of Certified Agricultural Standards, Certified Agricultural Standards organic, and good agricultural practices, including those with Taiwan Traceability Agricultural labels or Taiwan Agricultural Products Production Traceability QR codes, hereafter referred to as "4-labels-1-Q." However, in the general population, traceable labels are not yet well-known.

One study suggested that risk perception regarding food safety was based on both subjective consciousness and knowledge of risk (33). Another study found that risk perceptions help explain consumer purchasing behaviors because consumers seek to maximize utility and avoid possible losses (27). However, many external and internal factors can affect an individual's risk perception, and these factors integrate to become a psychological feeling. Risk perception has also been shown to be susceptible to fear of the unknown, which leads to risk-avoiding behaviors (7, 12, 37). Thus, risk perception is multidimensional, with ties to psychology, sociology, economics, etc.; a deep knowledge of customer risk perceptions requires a comprehensive understanding of consumer attitudes toward food safety (17). Notably, Mitra et al. (28) categorized food safety risk perception approaches as physics, quality, money, time, social, and psychological. This study also explored the phenomena caused by multidimensional risk perception.

Likewise, food safety perceptions can be divided into "consumer subject" and "product object." Consumer subject is an individual's awareness of food safety, in which food safety knowledge is influenced by individual differences due to external factors. Liu et al. (22, 23) found that gender, educational level, income, and occupation all influence consumers. Factors that influence the risk perception of product objects include food ingredients, producer brands, and food labels. Thus, the above studies found that when consumers made decisions in purchasing food, they not only conducted brand benefit assessments in their subconscious behavior but they also checked product manufacturing labels and nutrients according to individual health needs. The food label on product packaging, therefore, becomes the first consideration as consumers decide to purchase products.

Alternatively, a study suggested that purchase intention was an effective indicator of purchase behavior (13). More recently, purchase intention has been defined as the likelihood that a consumer will purchase a certain product (36). Another study divided the main factors driving consumer purchase of organic foods into the following categories: health orientation, environmental, price, and

self-value orientation (39). Risk perception, labeling, and attitude have also been noted to affect consumers' purchase intentions (30).

Based on the above premises, this study explored the relationship between the degree of familiarity with food labels on fresh foods and the risk perception of the participants. We further investigated whether food traceability systems can ultimately affect purchase intentions and whether giving information on food traceable labels to participants can drive the purchase of foods.

MATERIALS AND METHODS

Ethics statements. The Human Ethics Committee of the National Cheng Kung University Hospital approved the study protocol and the way informed consent was obtained (B-ER-107-320).

Research design. The study was conducted in the city of Tainan in southwest Taiwan. The flowchart is shown as Figure 1. The city was divided into three districts according to population density: <1,000, 1,000 to 5,000, and >5,000 people per km². The plan at the outset was to complete 100 questionnaire interviews in each district.

Questionnaire design. A questionnaire was developed to assess the impacts of label knowledge and risk perception on purchase intention among primary family food purchasers in Tainan. All participants signed a consent form before their inclusion in the questionnaire-based face-to-face interview.

The questionnaire had five parts: (i) demographic characteristics (gender, age, occupation, etc.); (ii) knowledge of traceable food labels (4-labels-1-Q) (see Supplemental Material, File 1); (iii) risk perceptions of fresh foods (physical risk, performance risk, financial risk, etc.); (iv) short education about label information (educational film); and (v) purchase intention toward traceable fresh foods, including the willingness to pay for food products with a label.

In part iv, an educational film made by the authors to introduce the 4-label-1-Q approach was shown to the participants (3 min, 46 s) after they had responded to basic questions relevant to demographic characteristics, knowledge of traceable food labels, and fresh food safety risk perception. Next, questions relevant to purchase intention toward traceable fresh foods were asked again after they saw the short educational film. The film was shown to participants in a simple and familiar way using a tablet computer, and the features of each label were subsequently compared, after which the participants understood more about traceable food labels.

All questions were answered using a 5-point Likert scale or multiple-choice methods. Points 1 to 5 in the Likert scale corresponded to "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree," respectively. The priority sequence represented the importance of food price, food quality, eco-friendliness, health considerations, appearance, and brand. Purchase intention was assessed using mainly vegetables, meat, and white rice in addition to the different labels and corresponding prices in markets and stores. "What label and price of fresh foods do you intend to choose?" was asked (see Supplemental File 2). Also assessed were consumer risk perception, in addition to their willingness to accept food products with additives (49), and consumer willingness to accept milk proposed to have come from cloned cows (4).

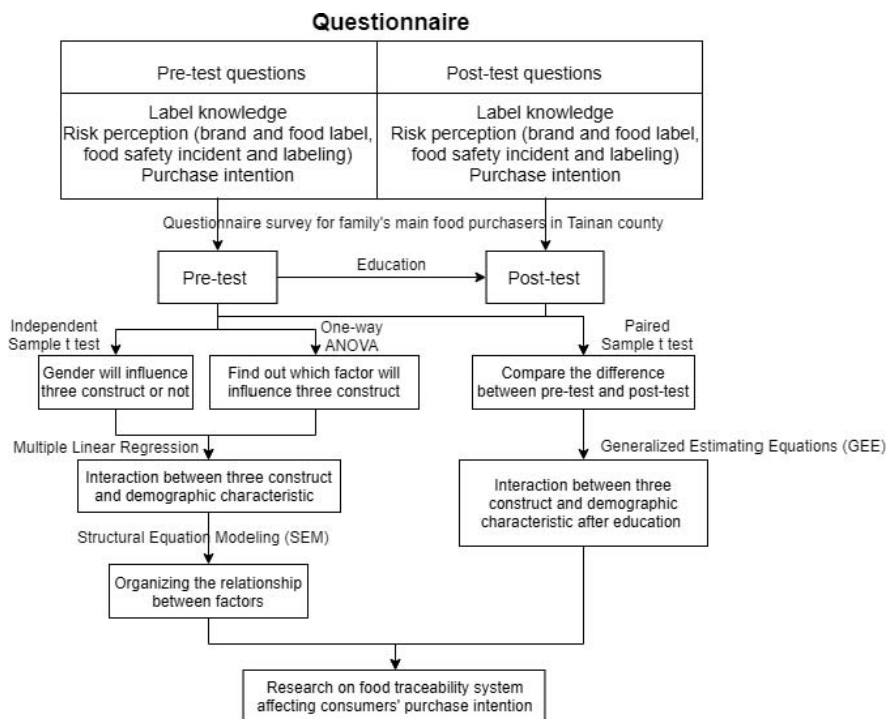


FIGURE 1. Flow chart of the study design.

Data collection. In each administrative region, traditional markets, hypermarkets, supermarkets, and convenience stores were selected. The reviewer randomly asked individuals who arrived at these markets and stores to participate in this study if they responded that they were the main food purchasers for their families. This phase was conducted from December 2018 to February 2019.

Before the formal use of this research questionnaire, its reliability was pretested by inviting main food purchasers from 14 families to complete it. Based on analysis of these results, Cronbach's α value of each construct was >0.7 , thereby indicating an acceptable level of reliability.

Data analyses. Subsequently, factor analysis was conducted, and the cumulative percentage explained variation (58.82%) was extracted and classified according to the questionnaire responses. Three new constructs were then renamed as "label knowledge," "risk perception" (labeling or brand), and "purchase intention" based on the results of the factor analysis (see Supplemental File 3).

Afterward, Cronbach's α method was used to test the reliability of participant responses regarding food label knowledge, risk perception, and purchase intention, to understand the correlations among these constructs. The questions were mainly answered using the 5-point Likert scale, which allowed the mean and standard deviation to be calculated for each variable; a higher score indicated greater emphasis on a given variable. Furthermore, Student's t test and one-way analysis of variance were used to test differences in label knowledge, risk perception, and purchase intention between males and females and among participants living in different districts. A paired sample t test was also conducted to determine whether there was significant change in the three constructs after the educational film on food labeling had been presented to participants. Additionally, we assessed whether this educational intervention improved each participant's purchase intention. Then, multiple linear regression and structural equation modeling were used to explore the relationships among the constructs and examine the degree of influence of various

pathways. In addition to linking a manifest variable (question) with a latent variable (construct) and considering the correlation between the two, structural equation modeling can use path analysis to establish a causal relationship between latent variables (35). All analyses were conducted using SPSS statistical software (version 24, IBM Corp., Armonk, NY).

RESULTS

Sample characteristics. In this study, 38 markets were visited, and 304 questionnaires were obtained. Of the 304 questionnaires obtained, 290 were valid, giving an effective questionnaire rate of 95.4%. Participants were mainly female (89.7%), with a high proportion of homemakers (36.6%) and fewer blue-collar (14.8%) and service industry (13.8%) workers. As for interview locations, 54.1% of the participants were recruited from traditional markets, 33.2% from supermarkets, and 12% from hypermarkets or convenience stores. Results showed that the population density of the area was negatively related to the age of participants but was unrelated to their educational level (Table 1). The degree of risk perception increased with an increase in household income up to a monthly income of USD 2,580, above which there was no further increase in risk perception. Additionally, participants from the traditional market had less familiarity with labeling and lower risk perception than those in the other purchase places.

Association among label knowledge, risk perception, and purchase intention of traceable foods. Label knowledge, risk perception, and purchase intention of participants significantly differed among age groups, educational levels, and purchase places (Table 2). Risk perception associated with labeling was significantly affected as well by educational level and label knowledge ($P < 0.05$). Risk perception associated with brands was

TABLE 1. Descriptive analysis of the food traceability system questionnaires from 290 participants

Category	No. (%)
Gender	
Male	30 (10.3)
Female	14 (100)
Age (yr)	
21–30	34 (11.7)
31–40	58 (20.0)
41–50	68 (23.4)
51–65	107 (36.9)
Older than 65	23 (7.9)
Occupation	
Student	7 (2.4)
Public servant	28 (9.7)
Worker	43 (14.8)
Business and financial operations	26 (9.0)
Service industry	39 (13.4)
Freelancer	17 (5.9)
Housewife	106 (36.6)
Retired	23 (7.9)
Other	1 (0.3)
Education level	
Elementary school	20 (6.9)
Junior high school	27 (9.3)
Senior high school	78 (26.9)
Bachelor's degree or equivalent	136 (46.9)
Post bachelor's degree	28 (9.7)
Income (New Taiwan Dollars [NTD])	
None	71 (24.5)
<20,000	44 (15.2)
20,000–40,000	109 (37.6)
40,000–60,000	43 (14.8)
60,000–80,000	18 (6.2)
>80,000	4 (1.4)
Marital status	
Never married	50 (17.2)
Married with no children	35 (12.1)
Married with minor children	72 (24.8)
Married with adult children	125 (43.1)
Divorced	6 (2.1)
Widowed	2 (0.7)
Purchase place	
Traditional market	158 (54.1)
Supermarket	97 (33.2)
Hypermarket	21 (7.2)
Convenience store	14 (4.8)

(marginally) significantly related to age, and label knowledge was assessed through multiple regression analysis (Table 3). The regression model also showed a significant association among participant purchase intention, educational level, and degree of risk perception associated with labeling ($P < 0.05$). Also, structural equation modeling showed a significantly positive relationship among label knowledge, risk perception, and purchase intention (Fig. 2). Thus, purchase intention was positively correlated with

label knowledge and was also affected by risk perception, whereas the degree of label knowledge also slightly affected the participants' risk perceptions.

Changes in risk perception and purchase intention after label education. Viewing a short film on food labeling significantly increased participants' label knowledge and purchase intentions but slightly decreased their risk perceptions, although this change was not statistically significant (Table 4). Concerning label knowledge, approximately 70% of the participants changed their answer, and 47.9% improved their label knowledge assessment responses after label education (data not shown). Furthermore, the purchase intention of the participants increased by more than 50% after label education.

Results showed that purchase intention was influenced by age, educational level, label knowledge, risk perception, and film education; among these, film education was most influential, followed by gender and educational level (Table 5). Pretest results showed that only education level and risk perception affected purchase intention at the start of the study. After film education, label education and income became significant factors.

Most influential factor in selecting traceable agro-products. Among the six influencing factors (i.e., price, quality, eco-friendliness, health benefit, appearance, and brand), health benefit was the most important factor, followed by product quality. Appearance and product price were the least important factors for the participants in selecting fresh foods (Fig. 3).

DISCUSSION

Relationship of demographic characteristics with label knowledge, risk perception, and purchase intention. This study found that label knowledge, risk perception, and purchase intention differed significantly according to age groups, education levels, and purchase places. In particular, younger participants had a greater knowledge of traceable labels, presumably due to their greater use of the internet and social media. Increased education levels correlated with greater understanding of label information. These observations agree with those of Henderson et al. (18), who reported that age and education level were significantly associated with trust in food factors, especially in young people who found the media least trustworthy. Findings also implied that participants with a higher income were more capable of avoiding risks. However, an intervention through purchase promotions for healthy choices in low-income urban areas was shown to improve intentions in making healthy food choices via shelf labeling (14). A nationwide survey using the random parameter logit model was used to evaluate the influence of food labeled "genetically modified" on U.S. consumers' willingness to pay for these products (30). Likewise, another study examined consumer willingness to accept milk based on whether or not it was represented to come from cloned cows. The survey revealed a low level of knowledge,

TABLE 2. Differences in scores relevant to label knowledge, risk perception, and purchase intention by different demographic data^a

	<i>n</i>	Label knowledge	Risk perception: labeling	Risk perception: brand	Purchase intention
Age group (yr)					
21–30	34	17.1 (2.58)* ^b	26 (2.83)*	12.7 (2.04)*	7.94 (2.44)*
31–40	58	17.4 (2.17)	26.9 (2.71)	13 (1.65)	8.74 (2.27)
41–50	68	16.9 (2.20)	25.6 (2.84)	12 (1.79)	8.07 (2.93)
51–65	107	16.5 (2.34)	25.5 (2.91)	12.2 (1.52)	7.68 (2.94)
Older than 65	23	15.0 (2.98)	23 (3.83)	11.2 (1.96)	5.78 (2.75)
Purchase place					
Traditional market	158	16.2 (2.47)*	25.2 (3.12)*	12.1 (1.79)	7.24 (3)*
Supermarket	97	17.3 (2.27)	26.3 (2.83)	12.6 (1.7)	8.51 (2.43)
Hypermarket	21	17.4 (2.11)	26.7 (3.15)	12.8 (1.83)	8.29 (2.45)
Convenience store	14	17.6 (1.74)	26.9 (2.43)	12.5 (1.4)	9.86 (1.61)
Educational level					
Elementary school	20	14.85 (2.91)*	23.1 (4.04)*	11.5 (1.1)*	5.05 (2.72)*
Junior high school	27	16.59 (2.1)	24.9 (2.55)	12.4 (1.5)	6.19 (3.13)
Senior high school	78	16.42 (2.2)	25.1 (3)	11.9 (1.87)	7.97 (2.68)
Bachelor's degree or equivalent	136	17.12 (2.5)	26.5 (2.83)	12.6 (1.74)	8.39 (2.6)
Post bachelor's degree	28	16.93 (1.9)	26.5 (2.44)	12.9 (1.74)	8.71 (2.29)

^a Mean and standard deviation (in parentheses).

^b * *P* < 0.05 by chi-square test.

including neutral opinions about animal cloning; this suggests that providing appropriate education and information can easily shape consumer opinion to either support or oppose cloning technologies (4). Labeling was found to be an important factor influencing consumer willingness to accept a food choice. Thus, labeling and packaging was proposed to contribute to consumer perception and purchase intention toward functional milks (1). These parameters were in addition to price and brand, which strongly affected consumer behavior patterns in selecting meats in shops (11). Additionally, it has been suggested that individual characteristics and educational levels were significantly associated with consumer risk perception scores (19, 34), including their purchase intentions (19). Likewise, brand was an important factor influencing risk perception (22). Shih and Hsu (39) found that as incomes increased, the awareness of risk among food workers also increased.

Relationships among label knowledge, risk perception, and purchase intention. Our research found that purchase intention was significantly influenced by the risk perception for labeling and was marginally influenced by label knowledge. Another study reported that consumer knowledge was significantly and positively correlated with purchase intention in the health care product market (2). Furthermore, an investigation that assessed consumer attitudes toward processed meat showed a positive preference for natural meat over that with chemical additives based on risk consideration (19). An evaluation of the influence of labels on purchase intention of wine consumers (9) in making healthy food choices (14) based on a product's nutritional information showed no shift in adults' purchase intentions (15). A study in Belgium additionally reported that pleasure value, symbolic value, risk importance, and risk probability were important factors in the selection of fresh meat (40).

TABLE 3. Associations among purchase intention, label knowledge, risk perception, and demographic variables by multiple linear regression analysis^a

Dependent variable	Independent variable	β coefficient	<i>P</i> value
Label knowledge (<i>R</i> ² = 0.326)	Age	−0.014	0.229
	Education level	−0.003	0.952
	Income	<0.0001	0.455
Risk perception: labeling (<i>R</i> ² = 0.353)	Education level	0.026	<0.001**
	Label knowledge	0.467	<0.001**
Risk perception: brand (<i>R</i> ² = 0.207)	Age	−0.013	0.056
	Label knowledge	0.461	<0.001**
Purchase intention (<i>R</i> ² = 0.201)	Education level	0.115	<0.001**
	Label knowledge	0.336	0.101
	Risk perception: labeling	0.798	<0.001**

^a The results were given by stepwise regression models.

^b ** *P* < 0.001.

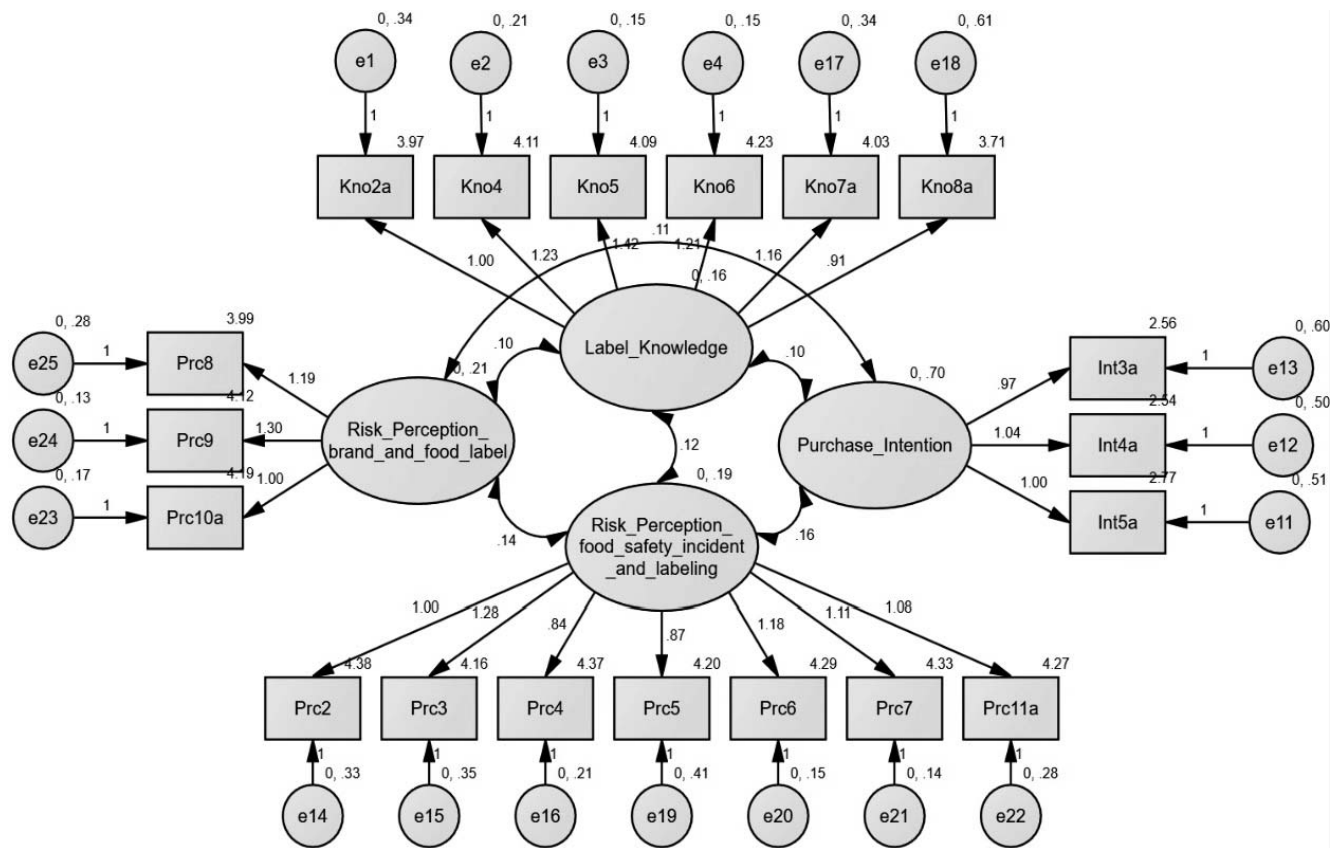


FIGURE 2. The structural equation model of pretest study.

Influencing factors in food selection. Consumers’ levels of nutritional knowledge influence their selection of processed foods (43). Likewise, studies have shown that misuse of food labeling information causes consumers to become vulnerable, misleading them to have positive attitudes toward particular foods in Singapore (42). A study that recruited participants through Facebook showed that consumers recognized healthier products by looking over their nutritional fact tables; however, these consumers cared more about global quality levels than the nutritional values of the products they purchased (43). A study of college students showed that star-based labeling gave healthy foods greater visibility. Nevertheless, nutrition label instructions and labels did not affect purchase intentions (24). Similarly, the above study reported food labeling as an obvious factor that influences consumers’ selection of foods. However, the influence of labels on purchase intention varied by age, as reported also in our study.

TABLE 4. Pretest and posttest differences after label education

	Pretest	Posttest	Mean difference	SD	P value
Label knowledge	4.29	5.01	0.109	1.86	<0.001 ^a
Risk perception	8.46	8.41	0.07	1.15	0.477
Purchase intention	7.86	9.27	0.141	2.40	<0.001 ^a

^a * P < 0.001.

One study explored how media communication affected consumers’ food safety recognition and consumer behavior (22). Another study found that TV and radio programs were important media for sharing knowledge of food safety with consumers in Turkey (8). Significant covariation has been observed among attitudes, knowledge, information perception, food labeling, behavior, and subjective norms in several studies (3, 10, 26, 28, 32, 44, 45). Furthermore, knowledge and attitudes toward food safety should focus on improving producers’ control of

TABLE 5. Associations among purchase intention, label knowledge, and risk perception after label education by generalized estimating equation analysis

Purchase intention	β	SD	P value
(Constant)	1.705	1.554	0.273
Education—no vs. yes	−1.332	0.163	<0.001 ^a
Gender	0.827	0.439	0.060
Age	−0.011	0.012	0.384
Occupation	0.014	0.055	0.802
Education level	0.106	0.046	0.021 ^a
Income	<0.001	<0.001	0.037 ^a
Marital status	0.083	0.117	0.476
Purchase place	0.265	0.157	0.091
Label knowledge	0.110	0.072	0.124
Risk perception—labeling	0.102	0.046	0.027 ^a
Risk perception—brand	0.066	0.083	0.428

^a * P < 0.05; ** P < 0.001.

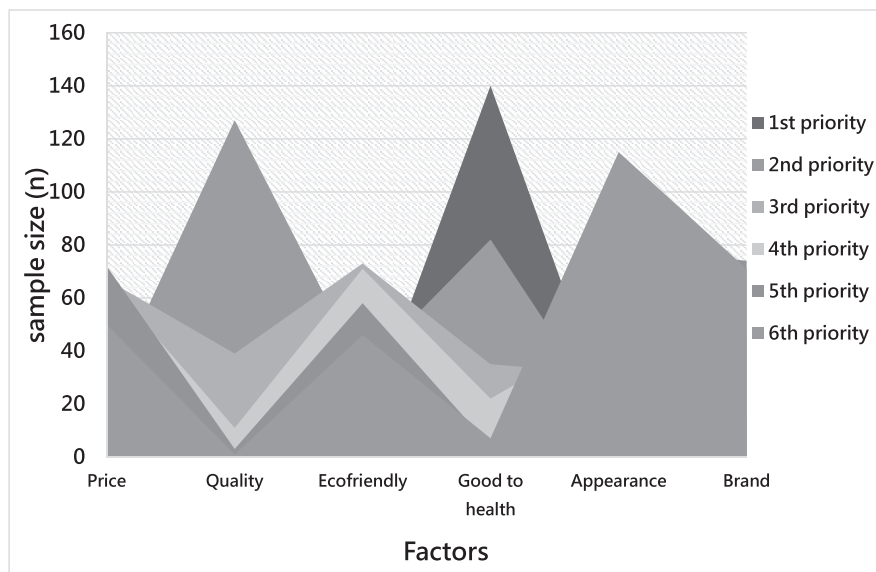


FIGURE 3. The priority of consumer choice.

Campylobacter and *Salmonella* in broiler chicken flocks by continuing education (49). This study found risk perception to be a less important factor in the purchase intention of consumers. Based on the purchase behavior findings, we believe that this parameter can be significantly improved after label education, which is consistent with the results of Liu and Lee (22).

Studies have shown that education and the presence of food traceable labels can help consumers select healthy foods (15, 20, 23). Therefore, although many people have now started to pay attention to food safety in the hope of providing themselves and their families with healthier and safer meals, the price of food remains an influential factor in food choices (6, 21, 47). However, this study showed that health benefits and product quality were the most important priorities of consumers. Likewise, a previous review article showed that food quality and safety were central issues that related to consumer perception and demand (16), whereas the appearance and price of products were least important. Consequently, consumers should understand the information provided in food labels. Also, as Thomas and Feng (40) mentioned, trusted sources of information increased risk perception, thereby causing consumers to adopt good behavior during the COVID-19 pandemic.

Based on the above results, we conclude that efforts should be aimed at consumer education through quality improvement, traceability, labeling, and communication. Our findings are in agreement with current research on the association of purchase intention with label knowledge and risk perception.

We note two limitations in our study: (i) the responses from the questionnaire were affected by the food safety issue and (ii) participants of this study were mainly food purchasers in Tainan. Therefore, although population density was used as a grouping indicator, it still did not represent the subjects of other counties and cities. Hence, it is recommended that future studies expand the research

scope, thereby making the results more representative for the Taiwan population.

This study found that film education significantly improved participants' label knowledge and purchase intentions but had less effect on their risk perceptions. Moreover, participants' age, educational level, income, and risk perception significantly affected their purchase intention. An increased understanding of traceable food labels and a higher perception of food risks was found to increase consumer willingness to purchase labeled foods. Therefore, to increase public trust in the food traceability system, a rigorous application of traceable food labels and an increased frequency of irregular sampling are needed. Additionally, the food industry should gradually integrate labels and upload production information to improve the food traceability system. This study successfully used an educational film to improve label knowledge and purchase intention. Development of suitable risk communication strategies to improve labeling knowledge among different age groups, including steps to encourage the sale of labeled foods in traditional markets, would be important strategies in the future.

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SUPPLEMENTAL MATERIAL

Supplemental material associated with this article can be found online at: <https://doi.org/10.4315/JFP-21-160.s1>

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