

W4177: Enhancing the Competitiveness and Value of U.S. Beef

Annual report

The 2019 annual meeting for W4177: Enhancing the Competitiveness and Value of U.S. Beef was held on June 23, 2019 in Loveland, CO. The meeting was held in conjunction with the Reciprocal Meat Conference (RMC) as the W4177 project was directly involved in this year's RMC program.

At 8:00, Amilton de Mello called the meeting to order and introduced Dr. Brett Hess (project administrator). Dr. Hess provided by video conference his administrative report. This included a summary of key project dates and timelines for reporting and a broader summary of the federal funding situation.

After the administrative report individual station reports were provided by those present. This included verbal reports for MS, KS, CA, NE, and NV. We then took a short break which allowed for some additional informal discussion. After our break, station reports resumed and covered ND, TX, IN, CO, ID, and MN.

Following delivery of station reports, we voted unanimously to retain the current leadership of W4177 for another year. It was further agreed that the next meeting date and location would be determined at a later time. The meeting was adjourned.

An annual report was compiled from station reports submitted to the current leadership of the W4177 after the annual meeting.

1. Accomplishments

California – James Oltjen: Beef production can be improved with more accurate predictions of animal growth and carcass composition with the analysis of modern cattle presented at the International Modelling conference in Cairns.

California – Scott Fausti: Fausti's contribution to the project is in the area of Objective 2 "Determine how changes in beef demand, marketing behavior, and market concentration have influenced the supply chain for beef in the United States. Determine how increased vertical integration and market concentration has affected the competitive market forces along the beef supply chain and the competitive position of U.S. beef in international markets." The South Dakota feedlot survey project is now complete. The data collected by the project has provided insight on the current feedlot management practices in the areas of production, marketing, risk management, and price discovery. In addition, survey data provides insight on how future capacity decisions by South Dakota feedlots may influence the future level of market concentration in the State. Consumer preference data on ground beef vs. ground bison has been collected and is being evaluated. Consumer sensory panel data matched to consumer experimental auction data is examining consumer sensory preference effect on willingness to pay.

Colorado –Keith Belk and Mahesh Nair: Colorado State University (CSU) has been actively engaged in several research projects during the past focusing on palatability, processing, and marketing of beef, prevention of food-borne illness, and consumer preferences for beef. The PIs are investigating the incidence and causes for antimicrobial resistance of bacterial pathogens in livestock production using metagenomics. Furthermore, Drs. Nair and Belk are working extensively in the area of red meat flavor

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chemistry and the development of instrumentation for segregation of flavor intensities and off-flavors. In that regard, research has been performed on beef flavor variations as it relates to different beef products. Research at CSU has also focused on the use of growth promotants on beef production, techniques for detection of growth promotants in meat, and the impact of these on global trade. Applied research projects to investigate the incidence of beef quality issues such as sour knuckles are also being undertaken. Further, research on nutritional information of red meat and the effect of broad and inconsistent classification of muscle food on dietary guidelines have also been undertaken as research topics in the past year.

Idaho – Phil Bass and Michael Colle: Beef meat science faculty efforts at the University of Idaho have been conducting research through the past year with focus on beef tenderness, color, and postmortem enzymatic activity. Focus has been on heavy weight carcasses and the effect of those carcasses on the merchandising of beef round cuts. Furthermore, research has been conducted on beef patties with potato starch inclusion to improve yield and palatability. Research with regard to commercially available genetic tests is underway to investigate the predictiveness of such tests on beef palatability. Additionally, some focus is underway looking more into how electrical stimulation of beef carcasses effects calpain activity. Finally, research into commercial dry aged beef facilities will investigate palatability differences amongst microbiomes.

Indiana – Brad Kim: Dr. Brad Kim at Purdue University is currently working on determining the impacts of post-harvest processing factors (aging, freezing and thawing, in particular) on meat quality attributes. Besides the post-harvest factors, Dr. Kim has been working on a collaborative project with Dr. Jon Schoonmaker at Purdue University to evaluate the impacts of supplementation of beef steers with ruminal bypass arginine on color and oxidative stability of aged beef loins.

Kansas – Glenn Tonsor: Collaborating faculty completed projects with the U.S. beef industry including launching of new monthly domestic and export beef demand indices. Other projects include ongoing work on livestock disease, biosecurity economics; examining how fed cattle negotiated prices are reported; estimating how changes in beef demand impact cattle producers; quantifying impact of SPS on beef trade and E. coli recalls on domestic beef demand.

Minnesota – Megan Webb: Efforts in Minnesota (Dr. Webb) have been focused on pre-harvest management influences on carcass characteristics and palatability. The PI has been focused on multiple projects that evaluate diet type and availability of diet during backgrounding and finishing on long-term animal and carcass characteristics. The projects also support evaluations in animal microbiome population. The PI is also evaluating treatments utilizing consumer sensory analyses and objective measures of beef palatability. The UMN has also been actively involved in offering Beef Quality Assurance and Secure Beef Supply trainings for the Minnesota Beef Council and the Minnesota Board of Animal Health. Research and Extension publications are being prepared in 2019.

Mississippi – Thu Dinh, Josh Maples, and Kalyn Coatney: Josh Maples is studying the technological innovations animal protein production impact on consumers and society. The primary rationale for the project is to determine if more efficient and larger carcasses lead to any negative (or positive) impacts on consumers and society. Thu Dinh and colleagues collected preliminary data for an oxidative stress model in beef cattle, potentially leading to discovery of important markers to be used to develop interventions to prevent oxidative stress damages. Electrostatic spray was found to improve color and

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antioxidant capacity of cherry extract used on grass-finished beef steaks. We initiated a project to determine whether longer than 24-h chilling duration would increase marbling score by making marbling more visible.

Nebraska – Gary Sullivan and Chris Calkins: UNL activities: Calkins presented a discussion session about dry-aged beef at the 2019 Reciprocal Meat Conference of the American Meat Science Association. Calkins has collaborative research with Nevada, Mississippi, and Texas A&M University. Continued collaborations are planned. Fresh meat research has focused on three main areas. These are the relationship of oxidative stress to meat tenderness, frozen meat color, and dry aging. Research on oxidative stress has been funded by the Nebraska Beef Council. Processed meat research has been conducted on factors influencing the spoilage microbiome.

Nevada – Amilton de Mello: Research conducted in Nevada showed that common organic acid applications to reduce STEC prevalence in beef processing are not effective. Bacteriophages targeting STEC seem to be the most efficient intervention during beef processing. When simulating High Event Periods scenarios, where subprimals associated to contaminated to positive trimmings are treated under vacuum conditions, commercial and experimental bacteriophage solutions improved STEC control whereas no significant reduction was observed when using organic acids such lactic and peroxyacetic. Research evaluating dry aging vs wet aging was also conducted in NV. De Mello reported that dry-aging periods up to 42 days did not influence beef flavor when comparing USDA Choice vs USDA Prime and wet vs dry aging. USDA grade plays the most important role in flavor perception from a consumer stand point. Results also showed that there is no effect on tenderness as well as on protein degradation when comparing aging methods (dry vs wet). Research involving nutrigenomics was initiated and NV showed that exogenous microRNAs from beef, molecules that may alter gene expression, are available for absorption at the duodenum when beef is consumed.

North Dakota - Robert Maddock: According to USDA market reports, slaughter weights for fed cattle are at all-time highs, and average over 100 pounds per head above the 5-year average. The market has changed to reflect these increased slaughter weights by lowering discounts for heavier carcasses, and it is not uncommon to see hot carcass weights in excess of 950 to 1000 pounds at many large packers. Along with these increased carcass weights, subcutaneous fat and, to a lesser extent, ribeye areas have increased as well (Igo et al., 2013). The chilling dynamic and postmortem metabolism that can ultimately affect the eating quality of meat from these larger carcasses has not been highly investigated, and much of the information found in the literature is dated and not necessarily applicable to the larger carcasses produced today (Lochner et al., 1980; Miller et al., 1997; Saleem and Majeed, 2014; Savell et al., 2005). In addition, the National Beef Tenderness Survey found large variations in postmortem handling and tenderness of beef carcasses of all weights and sizes, as well as abundant variation in primal and retail cut sizes and weights (Guelke et al., 2013) Research was initiated investigating relationships among carcass weight and meat quality attributes. Research was conducted to determine the impact of hot carcass weights on carcass and meat quality attributes.

2. Short-term Outcomes

California - James Oltjen: Developing collaborations and journal articles.

California – Scott Fausti: Data have been collected on Alternative Marketing Arrangements for fed cattle at the national level. Data will be used to look at price discovery and price transparency at the national level. Feedlot data have provided insight on small and medium sized feedlot management practices.

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Colorado – Keith Belk and Mahesh Nair: PIs served as members of advisory boards for major processing companies and research foundations, and integrated the research findings into university courses and curriculum. They have been invited and have served as members of closed research groups for targeted research dollars from industry associations. The red meat flavor research indicated that novel technologies such as Rapid Evaporative Ionization Mass Spectrometry (REIMS) could be beneficial for classification of beef based on flavor attributes. Furthermore, the research on sour knuckles indicated that the incidence might not be due to microorganisms that are culturable using traditional microbial culture methods. Significant improvements have been made in our understanding of the antimicrobial resistance and how the inconsistent classification of red meat affects the dietary guideline recommendations.

Idaho – Phil Bass and Michael Colle: The deep portion of the top round of larger carcasses takes longer to chill and therefore has a more rapid pH decline. This negatively affects the shelf-life of the top round. Regardless of carcass size, the deep portion of the top round has poorer color stability and is tougher than the superficial portion of the top round.

Indiana – Brad Kim: The results from our study found that dry-aging could improve eating quality attributes of low marbled grass-fed beef without adversely affecting microbial characteristics. From our freezing study, the findings from our study suggest that aging prior to freezing coupled with fast-freezing could be an effective way to minimize quality defects of frozen/thawed only meat, particularly water-holding capacity and tenderness. These findings will provide valuable information for the beef/meat industry to develop practical implications to improve meat quality and thus to increase their productivity and profitability.

Kansas – Glenn Tonsor: A better, deeper understanding of U.S. beef demand strength, determinants, and impact on cattle producers.

Minnesota – Megan Webb: The preliminary data of the present studies generates information that improves the understanding about diet type and timing on compensatory gain, duration of time on feed, periodic shifts in animal microbiome population over time, and the influence on carcass merit and consumer palatability. Moreover, the utilization of cover crops (purple top turnips, cereal oats, graza forage radish, and Hunter forage brassica) offer backgrounding cattle similar outcomes in performance as cattle backgrounded on a high roughage ration during backgrounding. Hosted and served on Minnesota advisory groups for the Agricultural Utilization Research Institute and the Minnesota Beef Council Research Committee.

Mississippi – Josh Maples, Kalyn Coatney, Thu Dinh: The results of Josh Maples project could lead to a better understanding of consumer preferences for meat from larger carcasses. Preliminary data on oxidative stress model in beef cattle was collected and will be used to further study oxidative stress damages in muscle and impacts on meat quality. Electrostatic spray is a potential better technology than conventional pressurizing spray with greater effectiveness and more cost-effective. We had preliminary data showing 96 h of chilling increase marbling score by 20 points, potentially shifting carcass top a higher quality grade.

Nebraska – Gary Sullivan and Chris Calkins: Results of research on frozen meat color have been used to provide advice directly to the meat industry. Presentations about dry-aged beef made to meat industry, students, and faculty in Brazil and to a professional conference in Australia. Interaction with industry

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has resulted in discussions on collaborative projects investigating factors influencing the shelf life of processed meat products.

Nevada – Amilton de Mello: Food Safety: Bacteriophages also affect commensal *E. coli*. However, previous research showed that if they reach human intestines no significant disruption of gut microbiota is observed. Preliminary results showed that phages have a diverse genome and constantly change after lysing different hosts. Meat Quality: Analysis of volatiles were performed to properly understand flavor development in dry-aged beef. Although the trained taste panel results were not different when comparing dry vs wet aging, it seems that there are still some differences in volatile compounds. Nutritional values: microRNA content varies as aging extends suggesting that there may be alterations of known meat quality genetic biomarkers.

North Dakota - Robert Maddock: Preliminary findings indicate that carcass weight does not adversely affect meat quality attributes, which provides evidence that large or heavy beef carcasses do not need to be treated differently during chilling and processing to maintain quality.

3. Outputs

California - James Oltjen: Journal articles.

California – Scott Fausti: One peer reviewed paper has been published of feedlot management trends. A second paper is under review. The second paper (under review) is on economic factors affecting future feedlot capacity decisions. A third paper is now in draft form. This paper investigates farmer feedlot risk management practices.

Colorado –Keith Belk and Mahesh Nair: Mahesh Nair received the 2018 Emerging Scholar from American Society of Animal Science, Southern Section. The PI's published 12 peer reviewed articles, submitted several abstracts at scientific meetings, and prepared several industry reports. Also, 2 M.S. and 1 Ph.D. students were graduated during the past year.

Idaho – Phil Bass and Michael Colle: Idaho published 4 peer-reviewed manuscripts and 7 abstracts. Additionally, Drs. Bass and Colle were frequently invited speakers at state and regional events. Dr. Bass is a speaker at the 2019 RMC and was the 2018 recipient of the AMSA's Achievement Award.

Indiana – Brad Kim: Dr. Brad Kim received Distinguished Achievement Award from American Meat Science Association (2018) and Outstanding Young Researcher Award from American Society of Animal Science, Midwestern Section (2018). He was also invited to give keynote lectures at the International Congress of Meat Science and Technology, Melbourne, Australia (2018), the IFT annual meeting, Chicago, USA (2018), the 50th International Conference of Korean Society for Food Science of Animal Resources, Jeju, Korea and several other invited seminars and workshops in Korea (2018).

Minnesota – Megan Webb: April 2018, Megan Webb initiated her role as an Assistant Professor in Beef Production Systems at the UMN. Peer-reviewed publications include: 1 manuscript, 1 additional manuscript submission, 4 published abstracts at scientific meetings, 1 published peer-reviewed proceedings paper, and 7 published Extension and research reports. In addition, 11 science-based presentations about beef were provided in Minnesota and beyond.

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Mississippi – Thu Dinh, Josh Maples, and Kalyn Coatney: Thu Dinh published 2 articles and 4 scientific abstracts, graduated 1 Ph.D. student, and presented research findings at 2019 Reciprocal Meat Conference and American Society of Animal Science annual meeting. Kalyn Coatney presented his cattle dynamic profit maximization rule at Dinklage Feed Yards, Iliff, CO.

Nebraska – Gary Sullivan and Chris Calkins: Calkins has published 7 articles in peer-reviewed journals, 3 in other peer-reviewed venues, and 2 abstracts from professional meetings. In addition, 7 science-based presentations about beef were given to national and international audiences. Sullivan published 2 manuscripts in peer-reviewed journals, 1 university research report, and 2 abstracts at professional meetings.

Nevada – Amilton de Mello: de Mello published 2 articles, 6 scientific abstracts, and presented food safety findings related to bacteriophage applications at the AMSA RMC 2019.

4. Activities

California – Scott Fausti: Invited speaker to European Commission workshop held on Market Transparency. Hosted by Directorate-General for Agriculture and Rural Development and Joint Research Centre. Title of presentation: “Effects of more transparency in the US meat market.” Work Shop held May 30-31, 2018 Brussels Belgium. Survey data was presented as a conference paper at the Western Ag Econ Association meeting held in Coeur d’Alene ID July 1, 2019. Fausti attended the RMC summer meeting in Loveland CO. At that meeting, he attended the annual meeting of the W-4177 and presented his annual report to the committee (June 23, 2019).

Colorado –Keith Belk and Mahesh Nair: Training was provided to several graduate students, and 2 M.S. and 1 Ph.D. degree were awarded. These research are at various stages of the publication process. In addition, CSU has hosted several large, multi-day workshops to discuss industry issues and present relevant research findings. Additionally, the PI’s have served as invited speakers at scientific meetings

Idaho – Phil Bass and Michael Colle: Hands on meat lab and research lab training were provided to 4 graduate and 12 undergraduate students in Meat Science. Two additional graduate students will be joining the team in June.

Indiana – Brad Kim: Published several peer-reviewed articles and presented numerous research abstracts/proceeding papers, served as invited speaker at international and national scientific meetings and workshops, trained 3 Ph.D. and 1 M.S. student, 4 visiting scholars and 2 undergraduate students for their research projects

Kansas – Glenn Tonsor: Tonsor is scheduled to present at the RMC related research tied to beef demand determinants.

Minnesota – Megan Webb: Webb: initiated trials and analyses of two live-animal studies at two UMN research centers. Research on animal performances has been led by training 1 Post-Doctoral researcher and carcass and meat quality analyses has been led by training 1 M.S. student. Upon the completion of these studies, results will be disseminated to many Extension programs, workshops, and lectureships. The PI also developed Extension programs including dissemination of Secure Beef Supply and Beef Quality Assurance state-wide.

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Mississippi – Thu Dinh, Josh Maples, Kalyn Coatney: The research in tall fescue led to funding to preliminarily investigate oxidative stress model in beef cattle. Research on natural antioxidants led to funding to determine the efficacy of various natural extracts on color, oxidation, and sensory quality of beef steaks. Currently, a M.S. student is also researching the effects of chilling duration on visibility of marbling.

Nebraska – Gary Sullivan and Chris Calkins: The committee presented a symposium session to the 2019 Reciprocal meat Conference of the American Meat Science Association, called “Enhancing the Competitiveness and Value of U.S. Beef.” Calkins participated in an international workshop on dry-aging of beef in Brazil and presented a discussion session about dry-aged beef at the 2019 Reciprocal Meat Conference of the American Meat Science Association. Multiple research projects were conducted on the topics of the relationship of oxidative stress to meat tenderness, frozen meat color, and dry aging. Research showed that oxidative stress of the live animal can impact subsequent meat quality. New information about the effects of relative humidity, air speed, muscle pH and blade tenderization on dry-aged beef was obtained. The impact of oxygenation level on color of frozen beef was explored. Sullivan has been conducting a variety of research projects looking at factors impacting the spoilage microbiome of processed beef products. Factors being evaluated including processing steps, antimicrobial ingredients, and smoke application. Additional research is being conducted investigating the safety of sous vide cooked beef products and influence of high-pressure processing treatment of beef quality and safety.

Nevada – Amilton de Mello: Developed research to understand how current food safety interventions effectively reduce pathogens of interest for the beef industry, effects of dry and wet aging on beef trained 3 graduate and 2 undergraduate students, served as the Nevada Food Safety Task Force chair, this project’s chair, and as a member for the USDA National Advisory Committee on Meat and Poultry Inspection. De Mello also develop research in meat quality and nutrition fields.

North Dakota - Robert Maddock: Two graduate students and two undergraduate students participated in the data collection, where they learned basic research protocols and procedures and how to collect important postmortem metabolism data and measure meat quality attributes such as color, tenderness, and drip loss of beef. How have the results been disseminated to communities of interest? This project was funded in part by the North Dakota Beef Commission.

5. Milestones

California – Scott Fausti: Findings gleaned from the South Dakota Feedlot Survey project are now being used in South Dakota beef Extension programing.

Colorado –Keith Belk and Mahesh Nair: Multiple research projects were completed and published during the year. Additional research is underway on several aspects of red meat quality.

Idaho – Phil Bass and Michael Colle: Funding is secured to continue to investigate the effect of carcass size on meat quality. Additionally, projects are funded to evaluate dry aging as well as utilizing antioxidants to extend the shelf-life of retail beef cuts.

Indiana – Brad Kim: Brad Kim delivered three keynote lectures at the premier international meetings (ICoMST, IFT and International Conference of Korean Society for Food Science of Animal Resources).

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Minnesota – Megan Webb: Received funding from the Iowa Beef Industry Council and the Minnesota Beef Council for research and Extension programs. These research and outreach programs will enable the beef industry to improve pre-harvest management decisions for improved carcass performance and sustainability.

Mississippi – Thu Dinh, Kalyn Coatney, Josh Maples: Thu Dinh will continue to develop an oxidative stress model in beef cattle to find appropriate markers for quality defects and will develop technology to assess flavor of beef.

Nebraska – Gary Sullivan and Chris Calkins: The committee presented a symposium session called “Enhancing the Competitiveness and Value of U.S. Beef” and Calkins presented a discussion session on dry-beef aged to the 2019 Reciprocal meat Conference of the American Meat Science Association. Calkins made an invited symposium presentation to an international workshop on dry-aged beef in Brazil. Meat pH may be important when dry aging as it relates to the ability of muscle to bind water. Therefore, a study was conducted to evaluate pH effects on water loss when dry aging and the effects on meat quality characteristics. Dry aging of dark cutting (DC), high pH beef may improve flavor and increase yield. Ultimate pH did not affect the rate and total moisture loss in dry aged beef. Dry aging of DC resulted in darker color and less red steaks, and decreased lipid oxidation when compared to WET-DC counterparts. Anecdotally, panelists noted inferior eating satisfaction associated with DC flavor, although they were not asked questions regarding preference. Results suggest that yield and flavor were not positively affected by dry aging of DC beef.

Nevada – Amilton de Mello: Nevada demonstrated that organic acids do not provide proper control of STEC and other interventions to minimize contamination are needed. Regarding meat quality, NV suggested that dry aging does not really alter flavor of beef aged up to 42 days. In addition, while evaluating microRNA profile of raw, cooked and digested beef, NV showed that beef microRNA may be absorbed by humans and alter health parameters. Also, genes, previously identified with meat quality biomarkers may have different expression as meat ages.

North Dakota - Robert Maddock: Research continues in this area with a project initiated to investigate consumer preference for steaks with varying sizes, weights, and shape. This project will determine if ribeye area, thickness, and size, and sirloin steak shape, thickness, and size influence consumer buying decisions.

6. Impact Statements

Colorado –Keith Belk and Mahesh Nair: The research undertaken at Colorado State University will enable the beef industry to understand consumer preferences for flavor, and enable them to take advantage of premium pricing to ensure long-term profitability and sustainability. Moreover, research on quality issues such as sour knuckles will facilitate reducing its incidence and improving the overall value of beef. Knowledge acquired through investigations of antimicrobial resistance will facilitate an informed decision making regarding antibiotic usage for livestock production..

Idaho – Phil Bass and Michael Colle: The previous and ongoing research at Idaho continues to work to improve product quality and consistency. Our main goal is always to find ways to increase beef consumption and thereby adding value to all segments of the beef industry.

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Indiana – Brad Kim: Dr. Kim's research program centers around three major research objectives: 1) identify fundamental biochemical mechanisms governing meat quality attributes, such as color, tenderness, flavor, water-holding capacity and juiciness, 2) develop innovative technologies from the live animal pre-harvest to the post-harvest chain of events to improve meat quality, and 3) identify and develop novel meat or non-meat ingredients to create values from underutilized low-value sources.

Kansas – Glenn Tonsor: Allocation of U.S. beef industry resources are improved given the actionable knowledge that followed from the research-based assessment of U.S. beef demand strength, determinants, and impacts on producers.

Minnesota – Megan Webb: On-going research at the UMN will enable beef producers to enhance their management decisions to ensure long-term profitability and sustainability. Knowledge attained from consumer preference and willingness to pay will allow the beef industry to improve meat marketing.

Mississippi – Thu Dinh and Kalyn Coatney: Our long-term goal is to discover novel pathways through which quality attributes of beef product can be manipulated to be more stable and consistent to meet consumers' demand and novel technologies that can be used to ensure safety of beef products, especially grass-finished beef and minimally processed beef. Two research directions on oxidative stress in beef cattle and technology to assess beef flavor will allow us to minimize defects and improve the consistency of the eating experience, thereby ultimately enhancing the competitiveness of the US beef products in the future.

Nebraska – Gary Sullivan and Chris Calkins: Research has been conducted investigating the effects cattle diet, biochemical processes (oxidative stress), ingredient technologies, and antimicrobial processes on beef and beef products quality and shelf life. These can be used by beef producers and processors to ensure production of high quality beef. Calkins received a grant from the Nebraska Beef Council to support research on oxidative stress (\$49,424,8/2018-7/2020) and the research on dry aging was previously funded by the Nebraska Beef Council (\$38,136, 8/2018 – 7/2020).

Nevada – Amilton de Mello: Bacteriophage applications provide optimal control of STEC in beef when compared to organic acids. USDA grade plays the most important role in flavor development whereas dry aging does not influence taste when meat is aged up to 42 days. MicroRNAs from beef may be absorbed by humans after digestion and may interact with human genes leading to epigenetics effects.

North Dakota - Robert Maddock: By determining if carcass size and weigh impacts value and consumer preference of beef steaks, we can provide information to the beef industry that can either verify that heavier carcass weights are not detrimental to quality or work to establish intervention such as alternative processing and cutting methods to limit impact of heavy carcass weights.

7. Publications

California - James Oltjen

1. Carabus, A., R.D. Sainz, J.W. Oltjen, M. Gispert, M. Font-i-Furnols. 2017. Growth of total fat and lean and of primal cuts is affected by the sex type. *Animal* Feb 10:1-9. doi: 10.1017/S1751731117000039.

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California – Scott Fausti

1. Diersen, Matthew A., and Fausti, S.W., “Feedlot Size, Backgrounding Behavior and Management Practices.” Accepted with minor revisions by Journal of ASFMRA, Vol.82, No.1, 2019: pp.128-132.
2. Fausti, S.W., and Diersen, Matthew A., “Competitive Forces Affecting Capacity Decisions of South Dakota Feedlot Operations” under review at Agricultural Economics.

Colorado –Keith Belk and Mahesh Nair

1. Davis, H. E., and K. E. Belk. 2018. Managing meat exports considering production technology challenges. *Anim. Frontiers*. vfy007. doi:10.1093/af/vfy007.
2. Weinroth, M. D., B. C. Britton, and K. E. Belk. 2018. Genetics and microbiology of meat. *Proc. Intl. Congr. Meat Sci. Tech*, Melbourne, Australia. *Meat Sci.* 144(2018):15–21. doi.org/10.1016/j.meatsci.2018.04.017.
3. Gredell, D. A., N. Sant’Ana, L. Arantes-Pereira, D. R. Woerner, J. F. Legako, J. N. Martin, J. D. Tatum, R. J. Delmore, and K. E. Belk. 2018. Understanding the impact of oven temperature and relative humidity on the beef cooking process. *Meat & Muscle Biol.* 2(1):334-343. doi:10.22175/mmb2018.04.0008.
4. Weinroth, M. D., A. D. Belk, and K. E. Belk. 2018. History, development, and current status of food safety systems worldwide. *Animal Frontiers*. 8(4):9-15. doi:10.1093/af/vfy016.
5. Perham, C.C., C. L. Gifford, D. R. Woerner, T. E. Engle, K. S. Sellins, R. J. Acheson, L. W. Douglass, J. D. Tatum, R. J. Delmore, A. Cifellic, S. H. McNeill, and K. E. Belk. 2019. Special-Fed Veal: Separable components, proximate composition, and nutrient analysis of selected raw and cooked, wholesale and retail cuts. *Meat Sci.* 148:19–31. doi: 10.1016/j.meatsci.2018.09.016.
6. Huebner, K., J. Martin, C. Weissend, K. Holzer, J. Parker, S. Lakin, E. Doster, M. Weinroth, Z. Abdo, D. Woerner, J. Metcalf, I. Geornaras, T. Bryant, P. Morley, and K. E. Belk. 2019. Effects of a *Saccharomyces cerevisiae* fermentation product on liver abscesses, fecal microbiome, and resistome in feedlot cattle raised without antibiotics. *Sci. Reports*. Feb 22;9(1):2559. doi: 10.1038/s41598-019-39181-7.
7. Howard, S. T., D. R. Woerner, D. A. Gredell, D. R. Sewald, T. C Bryant, D. J. Vote, J. A. Scanga, J. D. Tatum, and K. E. Belk. 2019. Effects of ractopamine hydrochloride and zilpaterol hydrochloride supplementation on feedlot performance and carcass characteristics of calf-fed Holstein steers. (Submitted to *J. Anim. Sci.*, January 2019).
8. Yang, X., Kalchayanand, N., Belk, K.E., and Wheeler, T. L. 2019. Photohydroionization reduces shiga toxin-producing *Escherichia coli* and *Salmonella* on fresh beef with minimal effects on meat quality. *Meat and Mus Bio.* 3, 105- 115.
9. Gredell, D. A., Schroeder, A. R., Belk, K. E., Broeckling, C. D., Heuberger, A. D., Kim, S-Y., King, D. A., Shackelford, S. D., Sharp, J. L., Wheeler, T. L., Woerner D. R and Prenni, J. E. 2019. Comparison of machine learning algorithms for predictive modeling of beef attributes using Rapid Evaporative Ionization Mass Spectrometry (REIMS) data. *Sci. Reports*, 9, Article number: 5721
10. Weinroth, M. D., B. C. Britton, K. R. McCullough, J. N. Martin, I. Geornaras, R. Knight, K. Belk , and J. L. Metcalf. 2019. Ground Beef Microbiome Changes with Antimicrobial Decontamination Interventions and Product Storage. *PlosOne*, <https://doi.org/10.1371/journal.pone.0217947>
11. Ramanathan, R., Nair, M.N., Hunt, M.C., Suman, S.P. (2019). Mitochondrial functionality and beef color: A review of recent research. *South African Journal of Animal Science*, 49, 9–19.
12. Nair, M.N., Canto, A.C.V.C.S., Rentfrow, G., Suman, S.P. (2019). Muscle-specific effect of aging on tenderness of three beef hindquarter muscles. *LWT Food Science and Technology*, 100, 250–252.

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Kansas – Glenn Tonsor

1. McKendree, M.G.S., G.T. Tonsor, T.C. Schroeder, and N.P. Hendricks. "Impacts of Retail and Export Beef Demand on United States Cattle Producers." *American Journal of Agricultural Economics*. Forthcoming.
2. Shang, X. and G.T. Tonsor. "Sanitary and Phytosanitary Regulations and International Red Meat Trade." *British Food Journal*. Forthcoming.
3. Appuhamilage, B.P.M. and G.T. Tonsor. "E.coli Recalls and Meat Demand: An Updated Assessment." *Journal of Agribusiness*. Forthcoming.
4. Britton, L. and G.T. Tonsor. (2019). "Consumers' Willingness to Pay for Beef Products Derived from RNA Interference Technology." *Food Quality and Preference*. 75:187-197. ([LINK](#)).
5. Bekkerman, A., G.W. Brester, and G.T. Tonsor. "An Alternative Approach to Measure Demand Changes in Meat Markets." *International Food and Agribusiness Management Review*. Forthcoming. ([LINK](#)).
6. Coffey, B.K., D.L. Pendell, and G.T. Tonsor. (2019). "Contemporaneous and Lagged Causal Relationships among Negotiated Live Cattle Cash Markets." *Journal of Agricultural and Applied Economics*. 51:182-198. ([LINK](#))
7. Schroeder, T.C., G.T. Tonsor, and B.K. Coffey. (2019). "Commodity Futures with Thinly Traded Cash Markets: The Case of Live Cattle." *Journal of Commodity Markets*. Forthcoming. ([LINK](#))
8. Tonsor, G.T. "Overview of KSU Export Meat Demand Indices." KSU-AgEcon-GT-2019.2. May 2019. ([LINK](#))
9. Tonsor, G.T. "Updated Overview of KSU Domestic Meat Demand Indices." KSU-AgEcon-GT-2019.1. May 2019. ([LINK](#))

Mississippi

Refereed articles:

1. Sukumaran, A. T., Coatney, K., Ellington, J., Holtcamp, A. J., Schilling, M., & Dinh, T. T. (2019). Consumer Acceptability and Demand for Cooked Beef Sausage Formulated With Pre-and Post-Rigor Deboned Beef 1. *Meat and Muscle Biology*, 3(1), 210-218.
2. Holtcamp, A.J., Sukumaran, A.T., Schnedler, A.E., McClenton, B.J., Kunze, E., Calkins, C.R., Karisch, B.B., Burnett, D.D., Dinh, T.T. (2019). Effects of feeding endophyte-infected tall fescue seeds to stocker Angus steers on retail quality attributes of beef strip steaks. *Meat Science*, 149, 31-39.

Scientific abstracts

1. McClenton, B. J, Goodman, J., Dong, O., Sukumaran, A., Holtcamp, A., Hart, C., Lemley, C. O., Aiken, G., Schilling, W., Baldwin, B., Martin, S., Blanton, J., & Dinh, T. 2019. Effects of feeding endophyte-infected tall fescue seed to Angus steers on ergovaline concentration, lipid oxidation, and skeletal metmyoglobin reductase activity. 2019 Joint ASAS/CSAS Annual Meeting, Austin, TX.
2. Sajeev, D., Thames, H. T., Cobb, H. C., Sukumaran, A. T., Holtcamp, A. J., Cavender, A., de Mello, A., & Dinh, T. T. N. 2019. Effects of electrostatic spray and natural antioxidants on sensory quality and color of grass- finished beef strip steaks. 2019 Joint ASAS/CSAS Annual Meeting, Austin, TX.
3. Sajeev, D., Thames, H. T., Burnett, D. D., & Dinh, T. T. N. 2019. Impacts of anatomical location on postmortem color of pork longissimus muscle. The 72st Reciprocal Meat Conference of the American Meat Science Association. Loveland, CO.
4. Haines, C., Sajeev, D., Coatney, K., &Dinh, T. 2019. Impacts of chilling duration on marbling score, shrinkage, and lean color in beef carcasses. The 72st Reciprocal Meat Conference of the American Meat Science Association. Loveland, CO.

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5. Thames, H. T., Sajeev, D., Cobb, H. C., Sukumaran, A. T., Holtcamp, A. J., & Dinh, T. N. T. 2019. Effects of electrostatic spray and natural antioxidants on chemical quality of grass-finished beef strips steaks.

Invited presentation

1. Coatney, K., Rivera, D., Dinh, T., and Marshall, T. 2019. Marketing fed cattle based on a dynamic profit maximization rule: evidence from a natural field experiment. Dinklage Feed Yards, Iliiff, CO.
2. McClenton, B. J, Sukumaran, A., Holtcamp, A., Vann, R., Lemley, C. O., Schilling, W., Baldwin, B., Martin, S., Blanton, J., & Dinh, T. 2019. Effects of Feeding Endophyte-Infected Tall Fescue Seed on Animal Performance and Carcass Characteristics of Angus Steers. The 72st Reciprocal Meat Conference of American Meat Science Association. Kansas City, MO.

Nebraska – Gary Sullivan and Chris Calkins

Journal Articles

1. Ribeiro, F. A., Domenech-Pérez, K. I., Contreras-Castillo, C. J., Wilkerson, E. K., Voegelé, H. R., Hart, K. B., Herrera, N. J., Calkins, C. R. (2018). Effects of dietary fat source on beef strip loin steak display life. *Journal of Animal Science*, 96, 2665-2674.
2. Malheiros, J. M., Braga, C. P., Grove, R. A., Ribeiro, F. A., Calkins, C., Adamec, J., Loyola Chardulo, L. A. (2019). Influence of oxidative damage to proteins on meat tenderness using a proteomics approach. *Meat Science*, 148, 64-71.
3. Ribeiro, F. A., Domenech-Pérez, K. I., Contreras Castillo, C., Wilkerson, E. K., Voegelé, H., Hart, K. B., Herrera, N. J., Calkins, C. (2018). Effects of dietary fat source on beef strip loin steak display life. *Journal of Animal Science* 96:2665-2674.
4. Ribeiro, F. A., Domenech-Pérez, K. I., Contreras-Castillo, C. J., Hart, K., Herrera, N. J., Calkins, C. (2019) Feeding distillers grains to cattle may affect beef tenderness early postmortem. *Journal of Animal Science*.97:657-668.
5. Hart, K. B., Ribeiro, F. A., Henriott, N. J., Calkins, C. (2019) Quality effects on beef from cattle fed high-protein corn distillers grains and other ethanol by-products. *Journal of Animal Science* 97:2087-2098.
6. Fruet, A. P. B., Nörnberg, J. L., Calkins, C., De Mello, A. (2019) Effects of different antioxidants on quality of beef patties from steers fed low-moisture distillers grains. *Meat Science* 154:119-125.
7. Holtcamp, Alexander J., Anuraj T. Sukumaran, Abigail E. Schnedler, Brandon J. McClenton, Emery Kunze, Chris R. Calkins, Brandi B. Karisch, Derris D. Burnett, Thu T.N. Dinh. (2019). Effects of feeding endophyte-infected tall fescue seeds to stocker Angus steers on retail quality attributes of beef strip steaks. *Meat Science* 149:31-39.
8. Sun, S., Rasumussen, F, Cavender, G., Sullivan, G. (2019) Texture, color, and sensory evaluation of beef steak treated with high pressure processing prior to sous vide cooking. *LWT- Food Science and Technology*. 103:169-177.
9. Posthuma, J., Rasmussen, F., Sullivan, G. (2018) Effects of nitrite source, reducing agents, and holding time on color development in a cured meat model system. *LWT – Food Science and Technology*. 95:47-50.
10. Gupta, J., Bower, C. G., Sullivan, G., Cavender, G. (2018) Effect of Differing Ingredients and Packaging Technologies on the Color of High Pressure Processed Ground Beef. *Journal of Food Quality*. Volume 2018:Article ID 4590143,
11. Other Peer Reviewed Educational Material
12. Ribeiro, F. A., Domenech-Perez, K. I., Herrera, N. J., Hart, K. B., Calkins, C. (2019). Impact of dietary fat source on beef tenderness. (vol. MP 106, pp. 111:113). The Nebraska Beef Cattle Report.

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13. Hart, K. B., Ribeiro, F. A., Henriott, M. L., Herrera, N. J., Calkins, C. (2019). Quality effects on beef from cattle fed high-protein corn distillers grains and other ethanol by-products. (vol. MP 106, pp. 108-110). The Nebraska Beef Cattle Report.
14. Malheiros, J. M., Braga, C. P., Grove, R. A., Ribeiro, F. A., Calkins, C., Adamec, J., Chardulo, L. A. L. (2018). Influence of oxidative damage to proteins on beef tenderness. International Congress of Meat Science and Technology. http://icomst-proceedings.helsinki.fi/papers/2018_10_20.pdf
15. Rasmussen, F., Sullivan, G. (2019). Comparison of Traditional and Alternative Curing Ingredients on Curing Reactions in a Model Meat System. (vol. MP 106, pp. 105-17). The Nebraska Beef Cattle Report.

Abstracts

1. Bland, N. A., Ribeiro, F. A., Hart, K. B., Herrera, N. J., Henriott, M. L., Calkins, C. (2019) Impact of diet on shelf life of beef steaks. *Journal of Animal Science*. 97(Supp. 2):In press.
2. Henriott, M. L., Ribeiro, F. A., Hart, K. B., Herrera, N. J., Bland, N. A., Calkins, C. (2019) Color stability of fresh and frozen beef. (vol. 97 (Supp. 2)). *Journal of Animal Science*. 97(Supp. 2):In press.
3. Rasmussen, F.D., Sullivan, G.A. 2018. Comparison of nitrite sources and reducing agents on reactions with myoglobin and cysteine using a model meat curing system. Reciprocal Meat Conference, Kansas City, MO, June 24-27, 2018.
4. Bower, C.G., Fernando, S.C., Sullivan, G.A. 2019. Spoilage microbiota of beef throughout various phases of processing. Reciprocal Meat Conference, Fort Collins, CO, June 23-26, 2019.

Nevada – Amilton de Mello

Journal Articles

1. Fruet, A.P.B., Nörnberg, J.L., Calkins, C.R., de Mello, A.S. 2019, "Effects of different antioxidants on quality of beef patties from steers fed low-moisture distillers grains" *Meat Science*. <https://www.sciencedirect.com/science/article/pii/S0309174018310477>
2. Fruet, A. P., Gerrard, D., Nörnberg, J. L. and de Mello, A. S. 2018, "Effects of fortification of beef steaks with krill oil on physical, chemical, and sensory characteristics" *Journal of Human Nutrition & Food Science*. <https://pdfs.semanticscholar.org/9854/4d874cd2c125345fc6f0767b3c690dbfe9e1.pdf>

Abstracts

1. Laidler, S. T., Shebs, E. L., Giotto, F. M., Lukov, M. J., de Mello, A. S. 2019. AMSA RMC, United States. Effect of the MS bacteriophage on STEC O157:H7 populations in beef
2. Shebs, E. L., Giotto, F. M., Lukov, M. J., Laidler, S. T., de Mello, A. S. 2019. AMSA RMC, United States. Effects of bacteriophage, ultraviolet light, and organic acid applications on STEC O157:H7 and the "Big Six" in beef packaged under vacuum and aerobic conditions
3. Cavender, A. M., Giotto, F. M., de Mello, A. S. 2019. AMSA RMC, United States. Effects of dry and wet aging on quality attributes of USDA Choice and Prime strip loins
4. Shebs, E. L., Lukov, M. J., Giotto, F. M., Torres, E. S., de Mello, A. S. 2019. AMSA RMC, United States. Efficiency of commercial bacteriophages on STEC O157:H7 populations in beef kept under vacuum and aerobic conditions.
5. Giotto, F. M., Evans, L. W., Ferguson, B. F., de Mello, A. S. 2019. Icomst, Germany. Availability of human homologous dietary microRNAs in cooked beef.

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6. Cavender, A. M., Giotto, F. M., de Mello, A.S. 2019. Icomst Germany. Effects of dry and wet aging on sensory attributes, instrumental tenderness, and lipid peroxidation of USDA-Choice and USDA-Prime tenderloins.

North Dakota - Robert Maddock

1. Fevold, M. A. 2019. Tenderness and Juiciness of beef steak from varying hot carcass weights. Thesis at North Dakota State University.
2. Fevold, M. A., K. L. Grube, W. S. Keller, K. R. Maddock-Carlin, and R. J. Maddock. 2019. Tenderness and Juiciness of beef steak from varying hot carcass weights. Proc of 2019 RMC. Accepted.

Indiana – Brad Kim

Journal articles

1. Setyabrata, D., Kim, Y.H.B.* 2019. Impacts of aging/freezing sequence on microstructure, protein degradation and physico-chemical properties of beef muscles. *Meat Science*. 151:64-74.
2. Teixeira, P.D., Tekippe, J.A., Rodrigues, L.M., Ladeira, M.M., Pukrop, J.R., Kim, Y.H.B., Schoonmaker, J.P.* 2019. Effect of ruminally protected arginine and lysine supplementation on serum amino acids, performance and carcass traits of feedlot steers. 97:3511-3522.
3. Balan, P.* , Farouk, M.M., Stuart, A.D., Kemp, R., Staincliffe, M., Craige, C., Kim, Y.H.B. 2019. Effects of electrical stimulation and pre-rigor conditioning temperature on ageing potential of hot-boned beef *M. longissimus lumborum*. *Animal Science Journal*. In Print.
4. Balan, P.* , Kim, Y.H.B., Stuart, A.D., Kemp, R., Staincliffe, M., Craige, C., Farouk, M.M. 2019. Effect of fast freezing then thaw-aging on meat quality attributes of lamb *M. longissimus lumborum*. *Animal Science Journal*. In Print.
5. Cramer, T., Kim, H.W., Chao, Y., Wang, W., Cheng, H.W., Kim, Y.H.B.* 2018. Supplemental impacts of probiotic (*Bacillus subtilis*) on meat quality and oxidative stability of breast muscle from broilers exposed to chronic heat stress. *Poultry Science*. 97:3358-3368.
6. Kim, Y.H.B.*, Ma, D., Setyabrata, D., Farouk, M.M., Lonergan, S.M., Huff-Lonergan, E., Hunt, M.C. 2018. Understanding postmortem biochemical processes and post-harvest aging factors to develop novel smart-aging strategies: A review. *Meat Science*. 144:74-90.
7. Berger, J., Kim, Y.H.B.*, Legako, J., Martini, S., Lee, J.W., Ebner, P., Zuelly, S.M.S. 2018. Dry-aging improves meat quality attributes of grass-fed beef loins. *Meat Science*. 145:285-291.
8. Xue, S., Qian, C., Xu, X., Kim, Y.H.B., Zhou, G*. 2018. High-pressure effects on myosin in relation to heat gelation: A micro-perspective study. *Food Hydrocolloids*. 84:219-228.
9. Cramer, T., Penick, M.L., Waddell, J.N., Bidwell, C.A., Kim, Y.H.B.* 2018. A new insight into meat toughness of callipyge lamb loins – the relevance of anti-apoptotic systems to decreased proteolysis. *Meat Science*. 140:66-71.
10. Kim, H.W., Kim, J.H., Seo, J.K., Setyabrata, D., Kim, Y.H.B.* 2018. Effects of aging/freezing sequence and freezing rate on meat quality and oxidative stability of pork loins. *Meat Science*. 139:162-170.
11. Kim, H.W., Setyabrata, D., Lee, Y.J., Kim, Y.H.B.* 2018. Efficacy of alkaline-treatment to improve functional properties of sugarcane bagasse fiber as a fat-replacer in meat emulsion. *Korea Journal for Food Science of Animal Resources*. 38:315-324.
12. Lee, Y.J.* , Kim, H.W., Kim, Y.H.B. 2018. New route of chitosan extraction from blue crabs and shrimp shell as flocculants on soybean solutes. *Food Science and Biotechnology*. 27:461-466.

Abstracts

1. Setyabrata, D., Tuell, J., Kim, Y.H.B.* 2018. Effect of aging/freezing sequence and freezing rate on quality attributes of beef loins. IFT. Chicago, Illinois.

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2. Guedes-Oliveira, J.M., Xue, S., Setyabrata, D., Kim, Y.H.B.* 2018. Effect of cilantro extract (*Coriandrum sativum*) application on color and oxidative stability of ground pork under different packaging conditions. The 71st Annual Reciprocal Meat Conference, Kansas City, Missouri.
3. Tuell, J., Kim, H.W., Setyabrata, D., Guedes-Oliveira, J.M., Seo, J.K., Schoonmaker, J., Kim, Y.H.B.* 2018. Supplementing beef steers with ruminal bypass arginine improves oxidative stability of aged beef loins. The 71st Annual Reciprocal Meat Conference, Kansas City, Missouri.
4. Setyabrata, D., Lee, J., Martini, S., Legako, J., Sobreira, T.J.P., Kim, Y.H.B.* 2018. Further investigations of dry-aging impacts on palatability attributes and metabolomic profiles of beef loins. The 71st Annual Reciprocal Meat Conference, Kansas City, Missouri.
5. Ma, D., Guedes-Oliveira, J.M., Duttlinger, A.W., Johnson, J.S., Kim, Y.H.B.* 2018. Effect of L-glutamine supplementation in replacement of antibiotics on meat quality attributes of pigs exposed to transport and weaning stress during different seasons. The 71st Annual Reciprocal Meat Conference, Kansas City, Missouri.

Conference Proceedings

1. Setyabrata, D., Ma, D., Cooper, B., Sobreira, T.J.P., Kim, Y.H.B.* 2018. Metabolomics profiling of meat exudate to understand the impact of postmortem aging on oxidative stability of beef muscles. In Proc. 64th International Congress of Meat Science and Technology. Melbourne, Australia.
2. Setyabrata, D., Lee, J., Martini, S., Legako, J., Cooper, B., Sobreira, T.J.P., Kim, Y.H.B.* 2018. Metabolomics profiling and chemical analyses to identify compounds associated with palatability attributes of dry-aged beef loins. In Proc. 64th International Congress of Meat Science and Technology. Melbourne, Australia.
3. Ma, D., Chao, Y., Duttlinger, A.W., Richert, B., Johnson, J.S., Kim, Y.H.B.* 2018. Effect of transporting weaned pigs under different season on meat quality and postmortem proteolysis of two porcine muscles. In Proc. 64th International Congress of Meat Science and Technology. Melbourne, Australia.

Idaho – Phil Bass and Michael Colle

Peer-reviewed articles

1. Colle, M.J., R.P. Richard, M.C. Colle, W.I. Loucks, G.K. Murdoch, C.J. Williams, and M.E. Doumit. 2019. Retail display properties and consumer perception of extended aged beef topically treated with ascorbic acid and rosemary extract. *Meat and Muscle Biology*. 3:42-50.
2. Colle, M.C., R.P. Richard, D.M. Smith, M.J. Colle, W.I. Loucks, S.J. Gray, Z.G. Reynolds, H.A. Sutton, J.A. Nasados, and M.E. Doumit. 2018. Dry potato extracts improve water holding capacity, shelf life, and sensory characteristics of fresh and precooked beef patties. *Meat Science*. 149:156-162.
3. Acheson, R., D. Woerner, M.J. Colle, C.E. Walenciak, and P.D. Bass. 2018. Distribution of marbling throughout the Longissimus lumborum of beef carcasses using an instrument-grading system. *Meat and Muscle Biology*. 2:303-308.
4. Colle, M.J., J.A. Nasados, J.M. Rogers, D.M. Kerby, M.M. Booker, J.B. Van Buren, R.P. Richard, and M.E. Doumit. 2018. Strategies to improve beef tenderness by activating calpain-2 earlier postmortem. *Meat Science*. 135:36-41.

Abstracts

1. Gouru, A., Z. Carlson, M.J. Colle, P. Bass, B. Murdoch, P. Rezamand, and G.K. Murdoch. 2019. Examining the effect of a physiological dose of the polyamine; spermine on myogenic regulatory transcription factor expression. *American Society of Animal Science*, Accepted.

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2. Insausti, K., M.J. Colle, P.D. Bass, I. Goenaga, O. Urrutia, J.A. Mendizabal, M.J. Beriain, and B. Soret. 2019. Effect of diet on bloom time of beef. Proc. 2019 Reciprocal meat Conf., Accepted.
3. Prill, L.L., T.G. O'Quinn, M.D. Chao, J.L. Vipham, J.M. Gonzalez, E.A. Boyle, T.A. Houser, M.J. Colle, and P.D. Bass. 2019. Chef and consumer evaluation of the degree of doneness of beef strip loin steaks cooked to six endpoint temperatures. Proc. 2019 Reciprocal meat Conf., Accepted.
4. Prill, L.L., T.G. O'Quinn, M.D. Chao, J.L. Vipham, J.M. Gonzalez, E.A. Boyle, T.A. Houser, M.J. Colle, and P.D. Bass. 2019. Profiling the impact of visual degree of doneness on palatability ratings of beef strip loin steaks served to consumers of differing degree of doneness preferences. Proc. 2019 Reciprocal meat Conf., Accepted.
5. Puga, K.J., J.B. Van Buren, J.A. Nasados, B.J. Buseman, P.D. Bass, K. Insausti, and M.J. Colle. 2019. Alternative merchandising strategy of the top round. Proc. 2019 Reciprocal meat Conf., Accepted.
6. Uhlenkott, A.L., J. Lancaster, I.W. Riley, J.A. Nasados, M.J. Colle, and P.D. Bass. 2019. Using a potato by-product to replace phosphate in enhanced whole-muscle turkey breast. Proc. 2019 Reciprocal meat Conf., Accepted.
7. Weber, T., M.J. Colle, J. Nasados, and P. Bass. 2019. Using genetic panels to determine tenderness in beef cattle. Western Section – American Society of Animal Science, Accepted.

Minnesota – Megan Webb

Peer-reviewed articles

1. Webb, M.J., J.J. Block, R.N. Funston, J.F. Legako, A.A. Harty, R.R. Salverson, K.C. Olson, and A.D. Blair. 2019. Influence of maternal protein restriction in primiparous heifers during mid- and/or late-gestation on meat quality and fatty acid profile of progeny. *Meat Sci.* 152:31-37. doi: [latehttps://doi.org/10.1016/j.meatsci.2019.02.006](https://doi.org/10.1016/j.meatsci.2019.02.006)
2. Webb, M.J., J.J. Block, A.A. Harty, R.R. Salverson, R.F. Daly, J.R. Yeager, K.R. Underwood, R.N. Funston, D.P. Pendell, C.A. Rotz, K.C. Olson, and A.D. Blair. 2019. Cattle and carcass performance, economic return, and environmental life cycle analysis of production systems utilizing different growth promotant technologies. *J. Anim. Sci. – In Submission.*

Scientific Meeting Abstracts or Proceedings

1. Langlie, J.A., B.O. Omontese, A.D. DiCostanzo, R.B. Cox, and M.J. Webb. 2019. Influence of cattle backgrounding systems on animal and carcass characteristics. Proceedings of the 72nd Annual Reciprocal Meat Conference, 2019. Fort Collins, CO.
2. Johnson, L.G., Grubbs J.K., Underwood K.R., Webb M.J., and Blair A.D. 2019. Proceedings of the 72nd Annual Reciprocal Meat Conference, 2019. Fort Collins, CO.
3. Webb, M.J., Cull cow management and beef marketing. Proceedings of the Northern States Beef Conference. Watertown, South Dakota, December 11-13, 2018.
4. Webb, M. University of Minnesota Research Update: Historical review and future research and facilities at the North Central Research and Outreach Center. Proceedings of the 79th Annual MN Nutrition Conference, 2018. Mankato, MN.
5. McKinney, S., Fehrman, C., Webb, M., Rhody, A., Grubbs, J. K., Underwood, K., Blair, A. SDSU bbq bootcamp increases consumer knowledge about meat selection and preparation. Proceedings of the 71st Annual Reciprocal Meat Conference, 2018. Kansas City, MO.

Extension Publications

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1. Webb, M.J., Growth promoting hormones in beef production and marketing. <https://extension.umn.edu/beef-news/growth-promoting-hormones-beef-production-and-marketing>. UMN Extension. (January 25, 2019).
2. Webb, M.J., How cattle producers can prepare for foot-and-mouth disease. <https://extension.umn.edu/beef-news/how-cattle-producers-can-prepare-foot-and-mouth-disease>. UMN Extension. (April 17, 2019).
3. Webb, M.J., The Beef Toolbox. https://www.agupdate.com/farmandranchguide/news/livestock/the-beeftoolbox/article_47ac296e-c70e-11e8-b4b3-fb7eee7cd3d2.html. Farm and Ranch Guide. (October 3, 2018).
4. Webb, M.J., Here are the statistics and studies favoring a diet that contains meat. https://www.agupdate.com/minnesotafarmguide/eedition/page-a/page_c24d2303-862e-5f7f-8089-85f482ef5a41.html. Minnesota Farm Guide. (September 14, 2018).
5. Webb, M.J., (work cited). Deal or no Deal: Suckling calf implants add value to cow-calf operations. South Dakota State University. <http://igrow.org/livestock/beef/deal-or-no-dealsuckling-calf-implants-add-value-to-cow-calf-operations/>. (June 12, 2018).

Professional Presentations

1. Webb, M.J., Translating beef production research to marketing outcomes. Waste to Worth Conference. St. Paul, MN. (April 26, 2019).
2. Webb, M.J., Meat labeling, what is required and what does it mean? Minnesota BBQ Society. St. Paul, MN. (April 12, 2019).
3. Webb, M.J., Implanting for success. Riverside Animal Veterinary Clinic. Springfield, MN. (January 22, 2019).
4. Webb, M.J., Cull cow management and beef marketing. Presentation. Northern States Beef Conference. Watertown, SD. (December 13, 2018).
5. Webb, M.J., U of M Beef Team update: current and future research and Extension efforts. Minnesota State Cattlemen's Convention. Alexandria, MN. (December 7, 2018).
6. Webb, M.J., 2018. Where we have been and where we are going in beef distribution. Minnesota Beef Council Beef and Sysco, St. Cloud, MN. (November 27, 2018).
7. Webb, M.J., When the steaks are high, how do we remain at the center of the plate? Seminar Presentation and Student Forum. Department of Animal Science. St. Paul, MN. (October 29, 2018).
8. Webb, M.J., Research and Extension Efforts at UMN. Presentation. Roy A. Wallace Symposium, Select Sires Inc. Palm Beach, FL. (October 15-18)
9. Webb, M.J., Review of dairy-beef cattle and carcass performance. Presentation. ADM Nutrition. Gilman, MN. (September 26, 2018).