

445 Large animal models of developmental programming. L. P. Reynolds*, J. S. Caton, K. A. Vonnahme, J. S. Luther, C. J. Hammer, K. R. Maddock Carlin, A. T. Grazul-Bilska, and D. A. Redmer, *Center for Nutrition and Pregnancy, and Animal Sciences Department, North Dakota State University, Fargo.*

Developmental programming refers to the long-term effects of various 'stressors' (e.g., maternal nutrient excess or limitation) on fetal or neonatal development; that is, 'programming' of organ systems during a discrete developmental period resulting in compromised function even in adulthood. This concept was first hypothesized based on the results of epidemiological studies in humans and has been subsequently confirmed with controlled animal studies. In addition to its effects in humans, developmental programming likely has profound implications for the efficiency of livestock production. The various large animal models of developmental programming will be described along with the effects

that have been observed in various organ systems. The models to be presented include those using cattle, sheep, and swine, and also will include models of maternal and neonatal nutrition (including energy, protein, and specific nutrients such as selenium), maternal age, maternal and fetal genotype, maternal environmental stress, and multiple fetuses. The critical importance of large animal models of developmental programming in solving socioeconomic and health-related issues also will be discussed. Moreover, the consequences of developmental programming for livestock production will be discussed, along with potential therapeutic approaches to minimize or at least manage these deleterious effects. *Supported by NIH grants HL64141 and HD45784, and USDA-NRI grants 2005-35206-15281 and 2007-012. We thank the many colleagues and students who have contributed to our research efforts over the years.*

Key Words: animal models, developmental program, socioeconomic implications

Meat Science and Muscle Biology: Pork and Beef Quality

446 Effects of dietary oxidative stress on postmortem events and tenderness of fresh pork. D. D. Boler*, L. W. Kutzler, A. C. Dilger, D. M. Fernandez-Duenas, S. F. Holmer, F. K. McKeith, and J. Killefer, *University of Illinois, Urbana.*

Extreme postmortem oxidation treatments have been shown to reduce proteolysis of beef steaks; which led to reduced protein degradation and delayed tenderization. The objective of this experiment was to determine if dietary oxidative stress from feeding finishing barrows highly oxidized oils reduced postmortem tenderization and delayed myofibrillar protein degradation. One hundred twenty barrows were allotted to a 2×2 factorial in a complete randomized block design with 3 blocks of 40 barrows each. Factors included oil type (fresh or oxidized) and dietary antioxidant (inclusion or exclusion). Fresh or oxidized corn oil was included in the diet at 5%, with or without 132 ppm antioxidant (ethoxyquin + tertiary butyl hydroquinone). Treatment diets were fed for the last 56 d of finishing prior to harvest. Barrows ($n=24$) whose live weights were closest to their respective pen means were selected for meat quality analysis and humanely slaughtered. Samples were collected to determine the overall effect of diet on oxidation in the carcass. Longissimus muscle was dissected between the 6th and 11th rib of the right side of the carcass at 24 h postmortem. Four pairs of chops were cut from the longissimus muscle beginning at the 6th rib. Pairs of chops were randomly assigned to aging durations of 1 d, 3 d, 7 d, or 14 d postmortem. Tenderness was analyzed on one chop using Warner-Bratzler shear force. Proteolysis of myofibrillar proteins was determined on the paired chop by Western blotting. No differences ($P > 0.05$) were detected in shear force values at any time points. No differences ($P > 0.05$) were detected in Troponin-T degradation between fresh and oxidized oil treatment groups; however, the presence of antioxidant appeared to accelerate ($P < 0.05$) myofibrillar protein degradation. The addition of highly oxidized oils in finisher pig diets does not appear to affect postmortem tenderization or myofibrillar proteolysis. Lack of differences in tenderness may be due to the level of oxidation in the oxidized oil treatment group being inadequate to illicit a response.

Key Words: pork, proteolysis, myofibrillar proteins

447 Effects of oxidized corn oil and synthetic antioxidant blend on pork quality and shelf-life. D. M. Fernández-Dueñas*, L. W. Kutzler¹, D. D. Boler¹, S. F. Holmer¹, J. Zhao², R. J. Harrell², J. Andrews², M. Vazquez-Añon², M. Ellis¹, F. K. McKeith¹, and J. Killefer¹, ¹*University of Illinois, Urbana,* ²*Novus International Inc., St. Charles, MO.*

The objective of this experiment was to evaluate the effect of oxidized oil and a blend of synthetic antioxidant (AOX, ethoxyquin and tertiary butyl hydroquinone; Novus International Inc.) on meat quality traits and shelf-life. The trial was a 2×2 factorial arrangement, with fresh vs. oxidized corn oil with or without AOX. A total of 32 barrows were selected for meat quality and shelf-life evaluation. Subjective color, marbling, and firmness, as well as objective color, pH and backfat depth (BD) were collected. Drip loss (loin chops) and percent moisture and fat were determined (loin chops and ground pork). Pigs fed oxidized oil had lower carcass yield ($P=0.01$) and pigs fed AOX had higher carcass yield ($P=0.05$) when fed either fresh or oxidized oil. Pigs fed AOX had 39% higher loin fat ($P=0.07$) and higher loin marbling score when fed fresh oil but not oxidized oil (AOX $P=0.08$, interaction $P=0.08$). Pigs fed oxidized oil had 13% lower Boston butt fat and less back fat depth at the 10th and last rib ($P<0.05$). Pork chops from pigs fed AOX were more juicy ($P=0.08$) and tender ($P=0.03$) and chops from pigs fed oxidized oil were less tender ($P=0.06$) after 14 days of storage. Shelf-life was measured as thiobarbituric acid reactive substances (TBARS) and discoloration score after stored in display cases for 0, 7, 14, and 21 days. After 14 and 21 days of storage, loin chops from pigs fed fresh oil with AOX had the lowest TBARS values and those fed oxidized oil without AOX had the highest. Chops from fresh oil without AOX and oxidized oil with AOX were intermediate (treatment effect $P=0.02$). Loin chops from pigs fed fresh oil with AOX had lower discoloration scores after 21 days of storage compared to those fed fresh oil alone ($P=0.008$). Results indicated pork quality was improved with dietary AOX supplementation by having lower TBARS and lower discoloration score. Pork chops from pigs fed AOX were more juicy and tender compared to the control.

Key Words: antioxidant, pork quality, TBARS

448 Impact of varying CO₂ and O₂ concentrations during stunning and carcass chilling conditions on pork quality traits. G. Bee^{*1}, M. Gerritzen², M. Mull², C. Biolley¹, G. Guex¹, B. Dougoud¹, and C. Vonnez¹, ¹Agroscope Liebefeld Posieux, Research Station ALP, Posieux, Switzerland, ²Animal Sciences Group of Wageningen, Lelystad, the Netherlands.

Commonly pigs are stunned using high CO₂ concentrations. Audible gasping in the stunner deliver evidence that, due to the high CO₂ levels, pigs experience a certain degree of discomfort, which might accentuate pre-mortem stress and, thereby, affect pork quality. Aiming to lower the adverse effects of inhaling high CO₂ levels, the addition of O₂/N₂ to lower CO₂ levels were tested (60: 60%CO₂+30%O₂+10%N₂; 70: 70%CO₂+30%O₂; 80: 80%CO₂+20%O₂; C: 87%CO₂+air). At 108 kg BW, 24 castrates from 4 litters were assigned within litter to 1 of the 4 stunning groups. Based on behavioral and electro-physiological measurements it was judged if pigs were properly stunned (data not discussed). Prior to bleeding, all animals were shot with a captive bolt. Carcasses were then scalded (7 min; 65°C), eviscerated and split. Both carcass sides were weighed and the left carcasses were conventionally (CC) cooled at 4°C for 24 h, the right carcasses were rapidly chilled (RC) for 120 min at -30°C and then stored at 4°C for 22 h. Regardless of the stunning gas, cold loss was 0.6% lower ($P < 0.01$) in RC- than CC-carcasses. Compared to C, postmortem (pm) pH of the LM (10 rib) was lower ($P \leq 0.05$) in carcasses of the 60- and 70-group (3 h: 6.1 vs. 5.7; 24 h: 5.5 vs. 5.4). Intermediate values were observed in carcasses of the 80-group (3 h: 5.8; 24 h: 5.4). At 3 h pm, but not at 24 h, the LM temperature was lower ($P < 0.01$) in RC- than CC-carcasses (12.1 vs. 19.1°C). LM temperature declined faster ($P < 0.05$) in C- and 70-compared to 80-group with intermediate values in the 60-group (3 h pm: 14.8, 14.5, 17.1, 15.9°C; 24 h pm: 2.9, 3.3, 3.4, 3.4°C). Drip loss percentage after 48 h was lower ($P < 0.10$) in loin chops of C- (4.71%) compared to 60- (7.58%) and 70- (6.66%) and intermediate values in the 80-carcasses (5.88%). Regardless of the stunning procedure, loin chops from RC-carcasses were tougher (5.0 vs. 4.3 kg; $P = 0.03$) than from CC-carcasses. From a quality point of view, the current results revealed that lowering the CO₂ level during stunning negatively affected pork quality and rapid carcass chilling had no alleviating effect.

Key Words: CO₂ stunning, rapid chilling, pork quality

449 Using ultrasound technology to predict intramuscular fat of loin in live pigs and potential use in swine genetic improvement. L. Maignel^{*1}, J.-P. Daigle², and B. Sullivan¹, ¹Canadian Centre for Swine Improvement, Ottawa, ON, Canada, ²Centre de Développement du Porc du Québec, Québec, QC, Canada.

The use of ultrasound technology to predict meat quality on live animals would be a quick, non-invasive and affordable method including numerous advantages for swine selection. To test newly available equipment, a group of 1,000 Duroc pigs were scanned using ultrasound technology and image analysis to estimate the intramuscular fat percentage in the Longissimus dorsi muscle using Biosoft Swine Toolbox software developed by Biotronics. Among these animals, 150 were slaughtered for a visual examination of marbling and a chemical analysis of intramuscular fat percentage in the Longissimus dorsi muscle. The correlations between in vivo measures with visual scores and chemical analysis were 0.55 and 0.69, respectively, in this sample. The standard error of prediction of chemical analysis from in vivo measures was 0.71%. The estimated heritability of intramuscular fat predicted in vivo was 0.69 and a moderately positive correlation was observed between this trait and backfat thickness as well as a significant negative correlation

with loin depth. These results are very encouraging with respect to the possibilities of using ultrasound on live pigs to efficiently predict the percentage of intramuscular fat and to select for this trait.

Key Words: intramuscular fat, ultrasound technology, pig

450 The effects of restricted feeding and subsequent realimentation on pig carcass composition. C. Chaosap^{*}, T. Parr, and J. Wiseman, Nottingham University, Loughborough, UK.

The effects of ad libitum feeding after a period of feed restriction were examined in female pigs which were allocated to 3 slaughter groups (S1, S2, S3 at 114, 116, 156 days of age). In S1 pigs were fed ad libitum (A40) or fed restricted to 0.70 of ad libitum for 40 days prior to slaughter (R40) (n=8). For S2, pigs were fed ad libitum throughout 42 day period (A42) and the other group feed restricted for 40 days followed by ad libitum for 2 days prior to slaughter (R40A2) (n=8). In S3, pigs were fed ad libitum for 82 days (A82) and the other group restricted for 40 days then ad libitum for 42 days before slaughter (R40A42) (n=8). At S1, A40 had a higher live weight and carcass weight than R40 ($P < 0.05$) but at S2 there was a trend for A42 carcasses to be heavier than R40A2 ($P < 0.1$), whilst in S3 there was no significant difference between A82 and R40A42 for live weight and carcass weight. For the individual muscles, longissimus muscle (LM), psoas, semitendinosus, when examined as a proportion of carcass weight, LM was greater in the groups exposed to restriction at S1 ($p < 0.1$) and S2 ($p < 0.05$) but not at S3. There was no difference between other muscles at all three slaughter dates. At S1 kidney and liver were smaller ($p < 0.05$) whilst there was trend for the heart also to be smaller ($p < 0.1$) in R40 compared to A40 when these tissues were examined as a proportion of live weight. However at S2 only the kidney was smaller in the group that had been restricted (R40A2) ($p < 0.05$) and at S3 there were no significant differences in any of these internal organs between groups. At S1 the level of IGF1 in the plasma was lower in R40 than A40 ($p < 0.01$), but at S2 there was a trend for the level to be lower in the group that had been restricted ($p < 0.1$), whilst at S3 there was no difference. The dietary restriction period influenced IGF1 plasma levels, which approached those levels of the ad libitum group when animals were refed, as did live weight and carcass weight. It appears that the internal organs, not muscles, underwent a compensatory response when animals were refed.

Key Words: pigs, compensatory growth, IGF1

451 Carcass traits of tropically adapted cattle when evaluated at different endpoints. S. W. Coleman^{*1}, D. G. Riley¹, C. C. Chase Jr.¹, M. F. Miller², J. C. Brooks², D. D. Johnson³, W. A. Phillips⁴, and T. A. Olson³, ¹USDA ARS STARS, Brooksville, FL, ²Texas Tech University, Lubbock, ³University of Florida, Gainesville, ⁴USDA ARS GRL, El Reno, OK.

Brahman (*Bos indicus*) derivative cows are well adapted to tropical conditions of Florida and the Gulf Coast, but calves are often discounted because their carcasses are perceived to be inferior. This work is from a 3-yr diallel crossbreeding study including Angus (A), Brahman (B) and Romosinuano (R), a tropically adapted *B. taurus* breed native to Colombia. Steer calves (n=477) of all possible breed combinations were weaned in Brooksville, FL and transported 2100 km to El Reno, OK for grazing wheat pasture and conventional feedlot finishing. Due to the great diversity on how the breeds mature, they were serially harvested at the IBP plant in Amarillo, TX after ~90, 120 and 150 days on feed.

Our objective was to compare selected carcass traits at different endpoints, constant days on feed (DOF), constant slaughter weight (SLWT), constant backfat (BF), and constant marbling score (MS). Mixed model analysis included fixed effects of year (n=3), breed type (n=9), winter grazing treatment (n=2), and the continuous variable for endpoint. All significant two-way interactions were included. Sire within breed was random. Overall, marbling score averaged 405 and 82% of the steaks were judged tender by both WBS (< 5 kg) and taste panel (> 5.0 OT score). Breed affected ($P < 0.05$) MS regardless of endpoint. At a time constant basis, MS was essentially linear with proportion A (573 for AA; 445 for Ax; and 349 for 100% tropically adapted steers). Longissimus area was influenced ($P < 0.05$) by breed group if DOF, BF, or MS were the endpoint, but not for SLWT. All endpoints significantly influenced Longissimus area. Tenderness (WBS) was different ($P < 0.05$) among breed types when SLWT or BF was the endpoint, and tended ($P < 0.10$) to be different if DOF and MS were the endpoint. Days required to reach the average MS were 115 for AA, 128 for Ax, 133 for RR and BR, 142 for RB, and 153 for BB.

Key Words: tropical adaptation, Brahman, Romosinuano

452 Sarcomere length influences postmortem proteolysis of Troponin-T in bovine muscle. S. J. Wells*, T. M. Nath, D. M. Wulf, and A. D. Weaver, *South Dakota State University, Brookings.*

Sarcomere length (SL) and proteolysis independently influence meat tenderness. In theory, the extent of overlap between actin and myosin is dependent on SL, which could affect substrate availability for the calpain protease system. The objective of this study was to evaluate the effect of varying SL on postmortem proteolysis of troponin-T (TnT) in intact bovine muscles. The right side of *Bos taurus* (n=7) and *Bos indicus* (n=7) carcasses were normally suspended (NS) and the left side of each carcass was hip suspended (HS). Samples were removed from the *Longissimus dorsi* (LD), *Semitenidinosus* (ST), and *Psoas major* (PM) at 0, 1, 4, 7, and 10 d postmortem. Myofibrils were isolated from samples aged 1, 4, 7 and 10 d and SL was measured using fluorescence microscopy and image processing software. Degradation of intact TnT was evaluated at 0, 1, 4, 7, 10 d using SDS-PAGE and Western blotting analysis. In LD and ST, sarcomeres were longer and degradation of TnT was greater for HS than NS ($P < 0.05$). In the PM, sarcomeres were shorter and degradation of TnT was reduced in HS compared with NS ($P < 0.05$). When data from all muscles were pooled and adjusted for the main effects of muscle and breed, the relationship of TnT degradation with SL was linear on d-1 and d-4 and quadratic on d-7 and d-10 ($P < 0.05$). On d-1 and d-4, degradation increased ($P < 0.05$) with increasing SL. On d-7 and d-10, longer sarcomeres resulted in greater degradation of TnT within the SL range of 1.7 - 2.5 μm , but no effect of SL on degradation was detected within the SL range of 2.5-3.9 μm . The effect of SL on proteolysis was most pronounced during the first 24 h postmortem as demonstrated by a linear relationship between SL and rate of TnT degradation from d-0 to d-1 ($R^2 = 0.26$). However, no relationship existed between SL and rate of TnT degradation from d-1 to d-10 ($R^2 = 0.01$). This study indicates that decreased SL results in decreased TnT degradation, by affecting proteolysis during the first 24 h postmortem.

Key Words: sarcomere length, proteolysis, TnT

453 Water access and the carcass characteristics of Holstein slaughter cows. K. D. Vogel*¹, J. R. Claus², T. Grandin¹, G. R. Oetzel², and

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During the marketing process, cattle may be exposed to periods of water deprivation. The impact of water withdrawal on the carcass characteristics and fresh meat properties of Holstein slaughter cows was examined through analysis of dressing percentage, postmortem pH decline, proximate analysis, and fresh meat color. Ninety-one multiparous Holstein cows (609 ± 89 kg mean body weight, 2.89 ± 0.51 mean BCS, varying stage of lactation) were purchased over three weeks in three groups (n = 31, 29, and 31) at a terminal market in central Wisconsin. Each cow was randomly assigned to one of three water withdrawal treatments (control, ad libitum access to water for 36 h; 18 h withdrawal, 18 h of ad libitum access to water followed by 18 h of water withdrawal; 36 h withdrawal, 36 h of water withdrawal). Mean ambient temperatures were $1.87 \pm 6.23^\circ\text{C}$ during the trial period. Following the water and feed withdrawal period, all cows were transported to a commercial slaughter facility. Mean muscle protein (%) increased ($P < 0.05$) between 18 h ($21.11 \pm 0.34\%$) and 36 h ($22.22 \pm 0.34\%$) of water and feed withdrawal. Mean muscle moisture (%) decreased ($P < 0.05$) between 18 h ($75.05 \pm 0.48\%$) and 36 h ($73.57 \pm 0.48\%$) of water and feed withdrawal. Mean 24 hour pH values were 5.94 (control), 5.99 (18h withdrawal) and 5.94 (36h withdrawal) (S.E. = 0.07) and were not different. Observed pH values indicate a borderline dark-cutter state across all cattle in the study, regardless of water treatment. This study determined some effects of water and feed withdrawal during marketing on meat characteristics of Holstein slaughter cows, particularly, the presence of a borderline dark-cutting state.

Key Words: dehydration, meat quality, dairy cow

454 Growth and carcass characteristics of steers fed an omega-3 fatty acid-fortified supplement from flaxseed while on improved pastures and following feedlot finishing. R. C. Vann*¹, S. T. Willard², E. L. Schenck², J. M. Martin², K. Moulton², W. Holmes², A. Brown², B. Thomas², T. E. Lawrence³, and M. S. Brown³, ¹MAFES-Brown Loam Exp. Stat., Mississippi State University, Raymond, ²Mississippi State University, Starkville, ³West Texas A&M University, Canyon.

The objectives of this study were to determine the potential of omega-3 fatty acid fortified supplements as an energy supplement to facilitate decreased mobilization of intramuscular fat deposition associated with cattle grazing forages and to enhance fatty acid content in meat tissue throughout the feedlot feeding period. Angus crossbred steers (n=42) maintained on ryegrass-bermudagrass pastures were assigned to either a control (CON; natural 15 molasses tub; Animal Feed Supplement, Poteau OK.) or an omega-3 fatty acid fortified tub (FLAX; flaxseed molasses tub; Animal Feed Supplement, Poteau OK). Steers were allowed to graze pastures with ad libitum access to tubs for 168 d and were then shipped to a feedlot with continued access to the tubs during the 121 d feedlot feeding period. Ultrasound body composition measurements and semitendinous muscle biopsies were collected on D0, 91 and 168 of the grazing period and longissimus steaks were collected at harvest. Steaks collected at harvest were analyzed for fatty acid profiles and Warner-Bratzler shear force measurements. The PROC Mixed procedure of SAS was used for data analysis. There were no differences ($P \geq 0.10$) in BW or ADG for the two treatment groups, except for ADG at the end of the feedlot period tended to be greater in the FLAX group compared to CON group ($P \leq 0.07$). The CON group had greater ultrasound ribeye area ($P \leq 0.05$) than FLAX group from D 91 throughout harvest. There were no differences ($P \geq 0.10$) in ultrasound intramuscular fat or carcass ribeye area, marbling scores, quality grades or yield grades between the

two treatment groups. CON steers tended to have greater % oil in steaks ($P \leq 0.08$) and a tendency for a greater C17:0 ($P \leq 0.09$) steak fatty acid content. In conclusion, FLAX supplementation while on pasture did not enhance growth or ultrasound body composition characteristics, and access to FLAX during feedlot finishing had little influence on steak composition post-harvest.

Key Words: flaxseed, steers, body composition

455 Impact of feeding *Fusarium graminearum*-infested barley on meat quality and fatty acid profiles in beef steers. S. L. Scott^{*1}, D. L. McLaren¹, H. C. Block¹, M. E. R. Dugan², Y. Wang³, and T. A. McAllister³, ¹Agriculture and Agri-Food Canada, Brandon Research Centre, Brandon, MB, Canada, ²Agriculture and Agri-Food Canada, Lacombe Research Centre, Lacombe, AB, Canada, ³Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB, Canada.

Little is known about the impact of feeding beef steers barley contaminated with the fungal pathogen *Fusarium graminearum* (FG) on meat quality and fatty acid profiles. Sixty-four steers (422±36 kg BW) housed in 8 pens were allocated to one of 4 experimental diets during a 56-day feeding trial. Basal diets comprised 80% whole barley (WB), 19% hay, 1% salt/vitamin/mineral premix (dry matter [DM] basis). FG-infested WB (24 ppm deoxynivalenol [DON]) made up 0, 26.7%, 53.3%, and 80.0% of the DM, with clean WB (<1ppm DON) comprising the remainder. At slaughter, carcass blue tag data were collected at the abattoir by a certified grader. One ribeye steak from each steer was analysed for percent moisture, crude protein (CP) and lipid by proximate analysis. Cooking loss and Warner Bratzler shear force were determined on a second steak following grilling to an internal temperature of 72°C. Fatty acid (FA) profile of lipid extracted from a third steak was analysed by GC following methylation to FA methyl esters (FAME) using the NaOCH₃/BF₃ double derivatization method; C19:0 was the internal standard. Conjugated linoleic acid (CLA) concentrations were confirmed with silver ion HPLC. Results were analysed with Proc Mixed of SAS. Diet had no impact on any carcass, meat quality or FA profile parameters ($P > 0.05$), except the n-6/n-3 ratio ($P < 0.01$), which varied in a cubic fashion with diet. Therefore, feeding FG-contaminated barley to beef steers does not negatively impact carcass or meat quality.

Table 1.

Parameter	Diet				SEM
	0	26.7	53.3	80.0	
Hot carcass weight (kg)	270.6	270.1	278.4	276.2	3.3
Grade fat (mm)	6.2	5.9	6.3	6.3	0.4
Yield grade	60.8	60.6	60.7	60.8	0.3
Rib-eye area (cm ²)	72.1	71.9	73.0	73.9	1.6
Moisture (%)	74.4	74.2	74.1	74.5	0.2
CP (% of DM)	79.5	79.7	78.8	80.2	0.6
Lipid (% of DM)	10.8	10.4	11.5	11.0	0.6
Cooking loss (%)	27.9	28.5	29.9	27.7	0.8
Shear force (kg)	5.9	6.2	6.0	6.3	0.3
C18:1 (t11) (% of FAME)	0.63	0.56	0.54	0.57	0.03
Total CLA (c9t11) (% of FAME)	0.15	0.14	0.13	0.14	0.01
Trans FA (% of FAME)	2.02	1.90	1.78	1.83	0.07
n-6/n-3 ratio	5.28	5.56	5.17	5.47	0.04

Key Words: *Fusarium graminearum*, beef quality, fatty acid profiles

456 Long-term supplementation with sunflower/fish oil-containing concentrates in a grass-based beef production system: Effects on colour and lipid stability during retail display. P. G. Dunne¹, F. J. Monahan², and A. P. Moloney^{*1,3}, ¹Teagasc, Ashtown Food Research Centre, Ashtown, Dublin, Ireland, ²University College Dublin, Belfield, Dublin, Ireland, ³Teagasc, Grange Beef Research Centre, Dunsany, County Meath, Ireland.

Increasing the concentrations of unsaturated fatty acids in beef may decrease its shelf-life. The effect on beef shelf-life of one nutritional strategy to alter fatty acids was examined. Sixty heifers were housed in November and fed either unwilted grass silage and a barley/soyabean meal concentrate (UC) or wilted grass silage and a concentrate containing sunflower oil and fish oil (WSFO). In May, both groups were offered either; pasture for 22 weeks (P); restricted P and sunflower oil and fish oil (SFO) for 22 weeks (PO22) or P for the first 11 weeks and restricted P and SFO for the final 11 weeks (PO11). Post-mortem, 21-day aged longissimus muscle (LM) was packaged in a high oxygen atmosphere and displayed for 10 days. Hunter colour coordinates ('L' (lightness), 'a' (redness), 'b' (yellowness)) were measured and saturation calculated on day 0, 1, 3, 6, 8 and 10. Percent metmyoglobin and the difference between reflectance at 630nm and 580nm (R630-R580) were calculated as indices of discolouration. Lipid oxidation on days 0 and 10 was assessed as 2-thiobarbituric acid reactive substances (TBARS). Data were analysed as a split-plot with effects for winter ration, summer ration, days on display and all interactions included in the model. There was no winter and summer ration interaction and no ration by display interaction. Neither winter ration nor summer ration affected vitamin E concentration in LM. The LM from WSFO heifers was more red (13.23 v. 12.62, $P=0.003$), yellow (8.48 v. 8.01, $P=0.027$), saturated (15.82 v. 15.07, $P=0.007$), had higher R630-R580 (20.31 v. 18.74, $P=0.004$) and lower metmyoglobin (29.06 v. 30.29, $P=0.024$) than LM from UC heifers. The LM from PO22 heifers had higher ($P < 0.05$) TBARS at day 10 (1.57, 1.82 and 2.11 mg/kg for P, PO11 and PO22, respectively). It is concluded that method of grass conservation affected muscle colour and that long term supplementation of grazing heifers with sunflower oil and fish oil increased lipid oxidation.

Key Words: cattle, color, TBARS