

Meat Science and Muscle Biology: Meat Science Poster Session 2

T151 Retail and sensory quality of Longissimus thoracis from steers fed corn- or wheat-based dry distillers grains plus solubles (DDGS). N. Aldai*¹, J. L. Aalhus¹, M. E. R. Dugan¹, T. A. McAllister², L. J. Walter³, and J. J. McKinnon³, ¹Agriculture & Agri-Food Canada, Lacombe Research Centre, Lacombe, AB, Canada, ²Agriculture & Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB, Canada, ³Department of Animal & Poultry Science, University of Saskatchewan, Saskatoon, SK, Canada.

Wheat is the cereal of choice for ethanol production in western Canada. However, in the USA corn is the principal source of DDGS and considerable volumes of this byproduct have been imported and used in western Canadian feedlots. While more is known about the feeding value and effects of corn DDGS on meat quality, there is limited data on wheat DDGS, and no direct comparison has been conducted. Hence, the objectives of the current study were to examine the objective and subjective retail display and sensory quality traits of 20 d aged steaks from cattle fed finishing diets containing corn (20 or 40%) or wheat (20 or 40%) DDGS (DM basis) compared to the barley control (n=20 per diet). After 4 d of display, DDGS samples had higher hue values (brownish-red) than control which coincided with a higher content of metmyoglobin (P<0.05). However, at the same time, 20% corn DDGS had a higher % of discoloration than 40% corn DDGS (P<0.05). Initial and overall tenderness were highest, perceived connective tissue was lowest, and the texture was the least rubbery in steaks from steers fed corn DDGS (P<0.05). In general, DDGS samples were rated higher for flavour desirability than the controls (P<0.05), and 20% corn DDGS had higher beef flavour intensity than 40% corn DDGS and were rated higher for overall palatability than any other sample (P<0.05). Some slight differences were observed in flavour descriptors, however there was no difference in liver-like off-flavour (P>0.10) which has been suggested as a possible consequence of feeding high levels of corn DDGS. According to these results, feeding wheat DDGS had no negative effects and any effect of the corn DDGS may ultimately be related to the fat content and/or composition of the carcasses.

Key Words: dried distillers' grains, retail measurements, sensory analysis

T152 Effects of feeding cattle increasing levels of dried distillers grains with solubles (DDGS) from wheat on muscle fatty acid composition. M. E. R. Dugan*¹, N. Aldai¹, D. J. Gibb³, T. A. McAllister³, and J. K. G. Kramer², ¹Lacombe Research Centre, Lacombe, AB, Canada, ²Guelph Food Research Centre, Guelph, ON, Canada, ³Lethbridge Research Centre, Lethbridge, AB, Canada.

Government incentives in North America have increased biofuel production and the most economical grain in western Canada for ethanol production is wheat. As demand for wheat increases so do grain prices which in turn creates incentives for feeding lower cost distillers' byproducts. Substitution of barley for wheat DDGS may also create opportunities for enhancing beef fatty acid profiles as reducing starch concomitantly increases dietary oil and may shift biohydrogenation towards healthier fatty acids. To study this potential, heifers were fed diets containing either 0, 20, 40 or 60% wheat DDGS (DM basis) substituted for rolled barley (n = 24; 133d finishing period). Adding DDGS increased dietary oil (from 1.9 to 3.7%) but dietary fatty acid compositions remained consistent. Feeding DDGS linearly decreased total diaphragm fatty acids on a mg/100g basis (P=0.03). On a percentage basis, feeding 20%

DDGS yielded more 16:0 (22.3%) than feeding 40% or 60% (21.2% and 22.0% respectively; P<0.05) but was not different from control (22.4%). Greater 16:0 is consistent with both a higher level of neutral lipid and total fatty acids. Increasing dietary DDGS linearly increased diaphragm 18:2n-6 (P<0.01) and total n-6 fatty acids (P<0.01) and this was accompanied by a linear decrease in 10t-18:1 (1.2 to 0.69%; P < 0.01), a linear increase in 11t-18:1 (1.07 to 1.37%; P < 0.01) but no change in total trans-18:1. Feeding DDGS also linearly increased 9c11t-conjugated linoleic acid (CLA) (0.34 to 0.41%; P=0.02) and linearly increased total CLA (0.48% to 0.55%; P=0.04). Feeding DDGS had no effect on diaphragm 18:3n-3 or total n-3 fatty acids. Overall, feeding DDGS enhanced the fatty acid composition of diaphragm muscle by decreasing the atherogenic 10t-18:1 while increasing 9c11t-CLA and its precursor 11t-18:1 that have potential roles in prevention and treatment of several diseases including cancer.

Key Words: beef, DDGS, fatty acid

T153 Effects of wet distillers grains feeding supplemented with vitamin E on fatty acid composition and sensory attributes of beef steaks. L. S. Senaratne*, C. R. Calkins, A. S. de Mello Jr., T. P. Carr, and G. A. Sullivan, University of Nebraska, Lincoln.

Effects of feeding wet distillers grains (WDG), distillers solubles (DS), and vitamin E (E) supplementation on fatty acid composition and sensory attributes of beef strip steaks (*M. longissimus lumborum*) were investigated. Crossbred yearlings (n = 90) were randomly assigned to one of ten diets contained 0, 20, or 40% (DM basis) WDG with or without E (500 IU of α -tocopherol/steer daily for 100 d) and DS (0 or 30% by wt of WDG). Strip loins were aged for 7 and 28 d at 2 °C and displayed for 7 d under simulated retail display conditions. Fatty acids profiles of steaks were analyzed using gas chromatography. Aged (7 and 28 d), pre- and post-displayed steaks were grilled (71°C) and presented to a trained sensory panel (8 panelists) to evaluate tenderness, juiciness, connective tissue content and off-flavor intensity based on 8-point hedonic scales. Diets having WDG increased (P ≤ 0.05) the amount of polyunsaturated fatty acids containing 18 or more carbons, omega-6, omega-3 and trans fatty acids of 18:1 isomers. No significant differences were found for total saturated, unsaturated and monounsaturated fatty acids. Tenderness, connective tissue contents and juiciness of pre- and post-displayed, 7 d aged steaks were not (P ≥ 0.05) influenced by E, WDG, DS, or their combination. Pre-displayed 7 d aged steaks from animals fed WDG+DS had higher off-flavor contents over steaks from cattle fed non-WDG+DS diets (P ≤ 0.05). However, WDG, DS, E, or their combination diets did not (P ≥ 0.05) influence tenderness, connective tissue contents, or off-flavor intensity of steaks from pre- and post-displayed 28 d aged steaks. The incidence of livery flavor was significantly higher in post-displayed, 7 d aged steaks from animals fed WDG+DS. Steaks from pre-displayed, 7 d aged from other diets did not have off-flavors (P ≤ 0.05). Feeding supplemented E resulted in lower levels of livery flavor for 28 d aged, post displayed steaks compared to steaks from non-E diets (P ≤ 0.05). Diets containing WDG+DS+E alter the fatty acid composition of beef and thereby increase off-flavors in strip steaks after retail display.

Key Words: beef, wet distillers grains, vitamin E

T154 Wet distillers grains with or without solubles and vitamin E supplementation alter proximate and mineral composition of beef.

L. S. Senaratne, C. R. Calkins*, and A. S. de Mello Jr., *University of Nebraska, Lincoln.*

Increasing levels of certain minerals (S, and Fe) may contribute to subsequent off-flavor production in beef during cooler aging. Therefore, this study was conducted to evaluate the effect of wet distiller grains (WDG), with or without distillers solubles (DS), and/or vitamin E (E) supplementation on proximate and mineral composition of beef. Cross-bred steers (n = 90) were fed 0, 20, and 40% WDG with or without DS and with or without E supplementation (500 IU of α -tocopherol acetate/head daily for 100 d) as a finishing ration for a period of 140 d. After slaughter, short loins (5 USDA Choice and 5 USDA Select carcasses from each dietary treatment) were aged for 7 d at 0 to 2 °C. Strip loins (*M. longissimus lumborum*) and tenderloins (*M. psoas major*) were analyzed for moisture, fat, ash, and mineral (Ca, P, K, Mg, Zn, Fe, Mn, Cu, S, and Na) levels. Fat, moisture, and ash percentages of strip loins and tenderloins from animals fed no DS diets containing 0, 20, or 40% WDG with or without E supplementation did not differ significantly. However, diets having DS or 40% WDG increased the fat levels of strip loins compared to no DS or 20% WDG diets ($P < 0.05$). Feeding DS to cattle increased the levels of Ca ($P < .0001$), P ($P = 0.0002$), Fe ($P < 0.0001$), Mn ($P = 0.01$), and S ($P = 0.01$) in strip loins. Strip loins from cattle fed WDG, DS, E or their combinations had similar levels of Zn, Na, and K ($P > 0.05$). In contrast, tenderloins from cattle fed WDG diets with E, DS or their combinations showed similar levels of Ca, K, Fe, Zn, S, and Cu ($P > 0.05$). However, Na and Mg levels in tenderloins significantly decreased when cattle were fed DS diets compared no DS diets. Feeding WDG, DS, and E supplementation significantly changes the mineral composition of beef strip loins and tenderloin muscles.

Key Words: beef, wet distillers grains, mineral

T155 Alternative muscles for traditional Japanese and Korean beef recipes. C. R. Calkins, A. S. de Mello Jr.*, L. S. Senaratne, and K. Watanabe, *University of Nebraska, Lincoln.*

The objective of this study was to verify the performance of different muscles in important Asian dishes. Typical dishes were tested twice (6 panels per country) using the traditional and three different beef muscles. Dishes were compared regarding appearance, aroma, juiciness, tenderness, flavor, and overall acceptability using a linear scale. Japanese dishes were sukiyaki (sauté), shabu-shabu (hot pot), and yakiniku (grill), whereas Korean dishes were jang jo rim (boiled), miyeok-guk (soup), and kalbi (grill). Native Japanese (n = 30 per session) and Korean (n = 20 per session) panelists and cooks (1 per country) were used. For sukiyaki, the alternative muscles *Biceps femoris* (BF), *Rectus femoris* (RF), and *Semimembranosus* (SM), were compared to *Longissimus dorsi* (LD) and no differences were observed in any attribute ($P \leq 0.05$). *Tensor fascia latae* (TFL), RF, and SM muscles were compared to *Triceps brachii* (TB) in shabu-shabu. The *Semimembranosus* was least desirable of all muscles ($P \leq 0.05$). *Tensor fascia latae*, RF, and TB were similar in all attributes except tenderness, where RF was least desirable ($P \leq 0.05$). For yakiniku, *Biceps femoris* - top sirloin cap (BFc), and *Infraspinatus* (IF), TF, were compared to *Serratus ventralis* (SV). The SV had highest juiciness ratings ($P \leq 0.05$), but BFc and IF were similar to SV in tenderness, flavor and overall acceptability. No differences were observed among muscles in appearance and aroma. For jang jo rim, BF, *Trapezius* (TP), and *Pectoralis* (PE) were compared to *Semitendinosus* (ST). No differences were observed except in tenderness where BF was significantly more tender ($P \leq 0.05$). *Digital extensor*

(DE), TFL, and SM were compared to SV in miyeok-guk. No differences in appearance were observed among all four muscles ($P > 0.05$). However, DG, TFL, and SV had higher values for all attributes when compared to SM ($P \leq 0.05$). For Kalbi, TFL, BFc, and IF were similar to SV in all traits ($P > 0.05$). Results indicate that other muscles may be used to replace traditional beef cuts from Japanese and Korean dishes, suggesting nontraditional U.S. beef cuts for the Asian market.

Key Words: beef, exports, Asia

T156 Fatty acid composition of western Canadian beef: Hamburger.

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Canadian regulations concerning trans fat levels in foods are being considered due to their atherogenic nature. However, not all fatty acids containing trans double bonds are unhealthy and some may actually be beneficial (i.e., c9,t11-conjugated linoleic acid (CLA) and its precursor vaccenic acid (t11-18:1)). A retail survey of lean beef, hamburger and backfat fatty acid composition in western Canada and a complementary study in eastern Canada have been conducted. Results for lean hamburger (15% fat) collected in western Canada are reported here. Hamburger samples were collected in February and July, 2007, from 30 supermarkets in Calgary (AB). Ground meat samples were freeze-dried and lipids were extracted using a mixture of chloroform and methanol (1:1, v/v). Lipid aliquots from each sample were methylated separately using acidic (methanolic HCl) and basic (sodium methoxide) reagents. Fatty acid methyl esters were analyzed using Ag+-HPLC and GC with a 100m column (CP-Sil 88). Summer samples (July) had significantly higher fat content than winter samples (February) (14.4% vs 12.4%; $P < 0.01$). Consequently, summer samples had significantly more saturated (6.6g vs 5.7g/100g; $P < 0.01$), branched-chain (320mg vs 256mg/100g; $P < 0.001$), monounsaturated (7.15g vs 6.11g/100g; $P < 0.01$) and polyunsaturated fatty acids (378mg vs 328mg/100g; $P < 0.01$). In percentages, however, the differences found between collections were less evident, which means differences found on a mg/100g basis were mostly due to the difference in fat content. Across collection periods, total CLA averaged 84.9mg/100g and total trans-18:1 averaged 424mg/100g. The major CLA isomer was c9,t11-CLA followed by t7,c9-CLA while the major trans isomer was t11-18:1 followed by t10-18:1. The CLA and trans 18:1 isomer profiles of hamburger were healthier than the profile we previously reported for backfat and striploin steaks which had higher levels of t10-18:1 and lower levels of c9,t11-CLA.

Key Words: beef, survey, trans

T157 Effect of slaughter end point on pH of beef carcasses from British or Continental versus Nellore crossbred cattle.

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The large variation in post-mortem muscle pH profiles may result in differences in meat quality traits. In the present study the aim was to investigate post-mortem variations in pH of *Longissimus dorsi* (LM) and *Semimembranosus* (SM) muscles from crossbred bulls carcasses at different body masses. Thirty six young (20 mo) bulls, 18 crossbred

F1 Red Angus × Nellore (½ RA ½ N) and 18 F1 Blonde D'Aquitaine × Nellore (1/2 BA 1/2 N) were used. The young bulls were feedlot finished and slaughtered at 480, 520 and 560 kg of shrunk body weight (SBW was measured before slaughter as the BW after 18 h without feed and water). A completely randomized experimental design in a 2 × 3 (2 genetic groups × 3 slaughter weights) factorial arrangement with six replicates was used. pH measurements were carried out at 0, 2, 4, 6, 10, 14, 18 and 24 h after slaughter in the LM and SM muscles. Data were analyzed using polynomial regression. Parameters were estimated through the REG procedure of SAS[®]. F test was applied with the purpose of verifying the equality of the regression parameters and identity of models fitted for the genetic group, slaughter weight and combination of both. The table below shows estimated parameters for the curves. There was no effect (P>0.05) of genetic group (GG) to curve parameters and identity of models for both muscles. However, there were effect (P<0.05) of slaughter weight (SW) and combination of both to all curve parameters and identity of models for the LM, and to initial pH (intercept) and identity of models for the SM. Therefore, muscle pH during carcasses chilling should be represented by different equations for the LM, but with common rates on pH change (L, Q, C) for the SM, respectively, according to the equations: $Y_{LM} = I + LX + QX^2 + CX^3$ and $Y_{SM} = I + 0.2625X - 0.0288X^2 + 0.0008X^3$.

Table 1. Parameter estimates of the muscle pH curves

Coefficients	½ RA ½ N			½ BA ½ N		
	480	520	560	480	520	560
LM						
I	5.6263	6.2726	5.4311	5.6766	5.8742	5.5242
L	0.3182	0.1458	0.2913	0.3277	0.3011	0.2924
Q	-0.0330	-0.0190	-0.0344	-0.0348	-0.0321	-0.0346
C	0.0008	0.0005	0.0010	0.0009	0.0008	0.0010
SM						
I	5.7281	6.2275	5.4655	5.6764	5.9436	5.6332
L	0.2887	0.1737	0.2949	0.2747	0.2876	0.2554
Q	-0.0302	-0.0199	-0.0336	-0.0285	-0.0300	-0.0307
C	0.0008	0.0005	0.0009	0.0007	0.0007	0.0009

I = intercept; L = linear term; Q = quadratic term; C = cubic term

Key Words: young bulls, *Longissimus dorsi*, *Semimembranosus*

T158 Post-mortem variation in temperature of beef carcasses in relation to breed and slaughter end point. R. Mello^{*1}, A. C. de Queiroz², F. D. de Resende³, M. H. de Faria³, G. R. Siqueira³, and J. S. de Oliveira², ¹Universidade Federal de Roraima, Boa Vista, Roraima, Brazil, ²Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, ³Agência Paulista de Tecnologia dos Agronegócios, Colina, São Paulo, Brazil.

The large variation in post-mortem muscle temperature profiles may result in differences in meat quality traits. In the present study the aim was to investigate post-mortem variations in temperature of *Longissimus muscle* (LM) and *Semimembranosus* (SM) muscles from crossbred bulls carcasses at different body masses. Thirty six young (20 mo) bulls, 18 crossbred F1 Red Angus × Nellore (½ RA ½ N) and 18 F1 Blonde D'Aquitaine × Nellore (½ BA ½ N) were used. The young bulls were feedlot finished and slaughtered at 480, 520 and 560 kg of shrunk body weight. A completely randomized experimental design in a 2 × 3 (2 genetic groups × 3 slaughter weights) factorial arrangement with six

replicates was used. Temperature measurements were carried out at 0, 2, 4, 6, 10, 14, 18 and 24 h after slaughter in the LM and SM muscles. Data were analyzed using nonlinear exponential model. Parameters of the model in question were estimated through the modified Gauss-Newton algorithm inserted in the NLIN procedure of SAS[®]. The likelihood ratio test with rapprochement through F statistical was applied to verify the equality of nonlinear regression parameters and identity of models fitted for the genetic group, slaughter weight and combination of both. The table below shows estimated parameters for the curves. There was no effect (P>0.05) of genetic group (GG) to curve parameters and identity of models for both muscles. However, there were effect (P<0.05) of slaughter weight (SW) and combination of both to all curve parameters and identity of models for both muscles, except to initial temperature (A) from SM. Therefore, muscle temperature during carcasses chilling should be represented by different curves for the LM, but with a common initial temperature for the SM, respectively, according to the equations: $Y_{LM} = B + (A - B)\exp(-Ch)$ and $Y_{SM} = B + (41.2 - B)\exp(-Ch)$.

Table 1. Parameter estimates of the muscle temperature curves

	½ RA ½ N			½ BA ½ N		
	480	520	560	480	520	560
LM muscle						
A, °C	32.7	35.6	36.9	32.8	36.1	34.8
B, °C	1.5	1.9	3.5	1.8	2.0	3.6
C, h ⁻¹	0.25	0.23	0.21	0.27	0.24	0.20
SM muscle						
A, °C	41.3	41.6	40.5	42.6	40.8	40.1
B, °C	1.3	3.3	-6.7	-4.6	4.1	-21.6
C, h ⁻¹	0.09	0.08	0.04	0.06	0.09	0.03

A = initial temperature; B = asymptotic temperature; C = rate of temperature decline

Key Words: crossbreed bulls, *Longissimus dorsi*, *Semimembranosus*

T159 Effect of breed and production system on the content of cis-9, trans-11 CLA in m. longissimus lumborum and m. semimembranosus of lambs. G. Davila El Rassi^{*1}, V. Banskalieva¹, and M. Brown², ¹R. M. Kerr Food and Agricultural Products Center, Oklahoma State University, Stillwater, ²USDA-ARS, Grazinglands Research Laboratory, El Reno, OK.

Katahdin (KK), Katahdin × Suffolk (KS), Suffolk × Katahdin (SK), and Suffolk (SS) wether lambs (n=24) born spring of 2007 were used to evaluate levels of CLA (C18:2_{c9t11}) from *longissimus lumborum* (LL) and *semimembranosus* (SM) muscle in concentrate and forage-fed lambs. Lambs were weaned and grazed on bermudagrass pasture until the end of August. Concentrate lambs were moved to drylot and 3 lambs of each breed group were fed on a mixed grain ration (12% CP, 76% TDN) for 88 d while a contemporary group of forage-fed lambs remained on bermudagrass until late September and then was moved to drylot and fed wheat silage for 69 days. Lambs were harvested at the Food and Agricultural Products Center, Oklahoma State University and muscle tissues sampled for fatty acid analyses. Data were analyzed by least squares procedures with linear models including fixed effects of treatment (concentrate vs forage-fed), sire breed, and dam breed, and all possible 2- and 3-factor interactions. There was little evidence of any interactions among fixed effects in these data. There was evidence (P<0.05) of treatment differences in CLA proportion in LL with forage-fed lambs greater than concentrate-fed lambs. There was also evidence of

direct breed effects in favor of Katahdin for CLA production in LL and SM lipids ($P < 0.01$) but little evidence of heterosis or maternal breed effects. Proportions of CLA in LL were greater in KK compared to KS ($P < 0.10$), SK ($P < 0.05$), and SS ($P < 0.01$). Proportions of CLA in SM were greater in KK compared to KS ($P = 0.05$), SK ($P < 0.01$), and SS ($P < 0.01$) and CLA in SM of KS and SK were greater than that of SS ($P < 0.01$ and $P < 0.10$, respectively). These results suggest that meat from Katahdin lambs is greater in CLA than meat from either crosses with Suffolk or purebred Suffolk and that meat from forage-fed lambs is greater in CLA concentration compared to meat from concentrate-fed lambs.

Key Words: breed, Diet, CLA

T160 Free amino acids profile in Biceps femoris of Iberian gilts fed betaine, CLA or both. I. Fernandez-Figares*, M. Lachica, J. M. Rodriguez-Lopez, L. Gonzalez-Valero, and J. F. Aguilera, *Spanish Research Council, CSIC, Granada, Spain*.

Betaine (BET) and CLA have the potential to alter growth and body composition in swine. Previous results in Iberian pigs have shown that BET and CLA have a synergistic effect on growth and carcass composition (Fernandez-Figares et al., 2008). The association BET+CLA elicited changes of the serum free AA profile in growing pigs consistent with an increased use of essential AA by peripheral tissues. Muscle is the tissue that has the largest need for essential AA, and that contains the largest free AA pool. The aim of the present work was to gain further insight by evaluating changes in Biceps femoris free AA profile of growing Iberian pigs fed BET, CLA or BET+CLA supplemented diets. Twenty Iberian gilts (20 kg BW) were individually penned and fed at 95% ad libitum barley-soybean meal based diets (12% CP, 0.81% lysine and 14.8 MJ ME/kg DM) containing either no added BET or CLA, 0.5% BET, 1% CLA, or 0.5% BET + 1% CLA. At 50 kg, pigs were slaughtered after an overnight fast and muscle samples were dissected and immediately frozen at -80°C until analysis. Free AA were determined by HPLC using the PicoTag method as described elsewhere (Fernández-Figares et al., 2003). AA concentrations are presented as $\mu\text{mol/g}$ of wet tissue. Data were analyzed as an ANOVA-I in a completely randomized design with treatment as the fixed effect. Significance was set at $P < 0.05$ and differences among means were determined using a Duncan's t-test. Tau, Ala and Gln were the most abundant non essential free AA. Val, Arg and Lys were the most abundant essential free AA. Overall, no significant differences were found between treatments for essential or non essential AA in the free AA pool. Increased carcass protein deposition in pigs fed BET+CLA supplemented diets was not reflected as changes in free AA at the Biceps femoris. It is possible that other muscles could have been more sensitive to the differences encountered at the whole animal level. Fernandez-Figares, Cuadros Rodríguez, González-Casado. (2003). *J. Chromat. B* 799: 73-79. Fernandez-Figares, Conde-Aguilera, Nieto, Lachica, Aguilera. (2008). *J. Anim. Sci.* 86: 102-111.

Key Words: free amino acids, betaine and cla, Iberian pig

T161 Feeding flaxseed to beef cows increases plasma omega-3 linolenic acid levels. M. L. He*^{1,2}, Y.-H. Chung¹, K. A. Beauchemin¹, P. S. Mir¹, J. L. Aalhus³, M. E. R. Dugan³, and T. A. McAllister¹, ¹*Agriculture & Agri-Food Canada Research Centre, Lethbridge, Alberta, Canada*, ²*Dept. of Animal and Poultry Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, Canada*, ³*Agriculture & Agri-Food Canada Research Centre, Lacombe, Alberta, Canada*.

Flax is an oilseed rich in omega-3 linolenic acid (LNA), which can be a precursor for other functional fatty acids such as conjugated linoleic acid (CLA) or elongate to eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA). Supplementing diets for beef cows with flaxseed may increase the LNA accumulation in muscle and fat tissues, but it has been speculated that omega-3 fatty acid enrichment is impeded when diets include silage. This study investigated the effect of supplementation of flax on plasma fatty acid profiles of beef cows fed diets containing different forage sources. Twelve Holstein cull cows were used in an experiment designed as a replicated 4×4 Latin Square with four 21-d periods. Diets were formulated to a 50:50 forage:concentrate ratio (dry matter (DM) basis), with forage comprising hay or silage, and with flaxseed supplemented at 0 or 15% of diet DM, replacing barley grain in the concentrate. The four diets, i.e., hay control (HC), hay plus flax (HF), silage control (SC), and silage plus flax (SF), were offered at 1300 h daily for ad libitum consumption. Blood samples were collected at 1500 h on d 14 and d 21. The lipids were extracted and methylated for fatty acid determination using gas chromatography. On d 21, mean LNA concentrations in plasma and weight % in total fatty acids were 244 mg/L and 17.9%, respectively, in the HF group, and 248 mg/L and 16.4% in SF. These values were much higher ($P < 0.01$) than were observed in the HC (66 mg/L and 6.6%) and SC (48 mg/L and 4.8%) groups. No differences in plasma LNA levels were observed between cows fed HF and those fed SF. Plasma EPA and CLA c9, t11 concentration, but not their weight % in total fatty acids, were also significantly increased in cows fed flaxseed. These findings suggest that relatively high levels of dietary LNA from flax will be delivered to muscle and fat tissues. Short-term flax supplementation of diets can be used to increase the healthy properties of beef.

Key Words: flaxseed, omega-3 fatty acids, conjugated linoleic acid

T162 Grazing or concentrate feeding for 11 months prior to slaughter: Influence on colour and sensory characteristics of beef. A. P. Moloney*^{1,2}, A. Black¹, P. G. Dunne², and F. J. Monahan³, ¹*Teagasc, Grange Beef Research Centre, Dunsany, County Meath, Ireland*, ²*Teagasc, Ashtown Food Research Centre, Ashtown, Dublin, Ireland*, ³*University College Dublin, Belfield, Dublin, Ireland*.

The effect of long-term pre-slaughter grazing or concentrate feeding on beef quality was determined. Fifty Charolais heifers (BW = 275 ± 27.0 kg, age = 252 ± 28 days) were assigned to either a pasture (P) or concentrate (C) ration on December 1. The P animals grazed a predominantly *Lolium perenne* pasture while C animals were housed in a slatted floor shed and offered a rolled barley (430 g/kg)/molassed beet pulp (430 g/kg) ration and 20% barley straw. The strategy was for P cattle to achieve their growth potential and to restrict the allowance of concentrates/straw such that both groups had a similar carcass weight. Rations were offered for 332 days prior to slaughter. Post mortem (48h), the colour of subcutaneous adipose tissue and longissimus muscle (LM) was measured using a Hunter Lab Ultra Scan colorimeter. Sensory characteristics of 14-day aged LM were assessed by a trained taste panel. Data were analysed accordingly to a randomized block (BW) design with assessor included as appropriate. Adipose tissue from P heifers was more yellow ($P < 0.05$) ('b' value 25.0 vs 17.7), more red ($P < 0.05$) ('a' value 11.1 vs 8.6) and darker ($P < 0.05$) ('L' value 67.6 vs 71.4), than that from C cattle. There was no effect of pre-slaughter diet on ultimate muscle pH (5.54). Muscle from P heifers was darker ($P < 0.05$) (34.3 vs 35.60), less red ($P < 0.05$) (15.2 vs 17.2), less tender ($P < 0.05$) (4.23 vs 4.48, 8 point scale) and less preferred ($P < 0.05$) (39.0 vs 42.3, 100 line scale) than muscle from C heifers. There was no difference between

rations in juiciness, beef flavour intensity, abnormal flavour intensity or in the flavour attributes of greasy, bloody livery, metallic, bitter, sweet, rancid, fishy, acidic, cardboard or vegetable/grassy. It is concluded that while statistically significant, the absolute differences in colour and tenderness were small and may not be detected by consumers.

Key Words: beef colour, sensory

T163 The influence of forage diets and aging on beef palatability. T. Jiang*¹, J. R. Busboom¹, M. L. Nelson¹, J. O'Fallon¹, T. P. Ringkob², D. Joos², K. R. Rogers-Klette², and K. Piper², ¹Washington State University, Pullman, ²University of Nevada, Reno.

To investigate the influence of diet and aging on beef palatability (beef steak and ground beef), lipid oxidative stability, and fatty acid composition, crossbred steers were assigned in a Completely Randomized Design to dietary treatments of Feedlot S (finished on alfalfa and grain), Forage 1 (triticale and annual rye grass), Forage 2 (triticale and kale), or Combination (grazing rye, fescue and orchard, finished on alfalfa and grain). Heifers were finished on alfalfa and grain (Feedlot H). Two longissimus muscle steaks from five animals per dietary treatment and three trimmed triceps brachii muscle samples from four animals per dietary treatment were collected. Steaks were either dry- or wet-aged for 14d. Ground beef samples were dry-aged, or wet-aged for 14d, or not aged. Nine-member trained sensory panels were conducted to evaluate palatability attributes of beef steaks (beef flavor, off-flavor, initial tenderness, sustained tenderness, and juiciness) and ground beef (beef aroma, off-aroma, beef flavor, off-flavor, tenderness, and juiciness). There was no ($P > 0.05$) effect of diet or aging on cooking weight loss. Diet and aging treatment did not ($P > 0.05$) influence the palatability of beef steaks. Similarly, diet did not ($P > 0.05$) influence the palatability of ground beef. However, aging impacted ($P < 0.05$) ground beef sensory attributes and the influence depended on dietary treatment or possibly animal sex. In general, aging negatively affected ground beef palatability. Furthermore, dry-aging had more negative effects on palatability than wet-aging. Dietary and aging treatments had no ($P > 0.05$) impact on lipid oxidative stability of raw ground beef but affected the fatty acid composition. Therefore, to maintain ground beef palatability aging should not be practiced.

Key Words: beef palatability, beef aging, cattle diet

T164 Influence of management systems on meat quality of heifers fed with different lipid supplements in the finishing phase. M. C. A. Santana*¹, T. T. Berchielli¹, R. A. Reis¹, A. V. Pires², G. Fiorentini¹, and M. A. A. Balsalobre³, ¹São Paulo State University, Jaboticabal, São Paulo, Brazil, ²São Paulo University, Piracicaba, São Paulo, Brazil, ³Bellman, Mirassol, São Paulo, Brazil.

The feeding strategy is the management tool most widely used as a quality control method in the production conditions of meat. The areas of focus in this experiment are colors a, b, L and shear force (WBSF), water-holding capacity (WHC), pH and cooking loss percentage (CLoss) in meat from heifers fed with different lipid supplements in the finishing phase system. The experiment was completely random design, using a 3×2 factorial arrangement (3 supplements and 2 systems). The supplements came from 3 different sources; soybean grains, soybean oil and protected fat (MEGALAC-E), the two finishing phase systems came from pasture (0.75% of BW) or feedlot (60:40 concentrate: corn silage). The treatments were compared by analyzing variables using the GLM procedure (SAS 9.1, SAS Institute, Inc., Cary, NC). Mean values were compared using the Tukey test at a significance level of 0, 05. Using a colorimeter, the color of the longissimus muscle (LM) at the 12th and 13th rib interface in the $L^*a^*b^*$ color space (CIE system) was determined. A time span of 30 minutes was awaited before color analysis. The WBSF was obtained from steaks previously thawed and roasted using an insert thermometer until 70°C was obtained. Later, the samples were cut into cubes; the data collected was achieved using a Warner-Bratzler shear machine. The muscle pH (pHu) measurements were taken from the interior of the LM at 24 h postmortem using a portable pH meter. The water holding capacity was obtained by determining the difference of the sample weights under 10 kg of pressure for 5 minutes. The cooking loss value was determined according to the reduced percentage rate before and after the meat was cooked. The meat attributes were not influenced by the supplements, however, the meat from the pasture systems showed a significantly higher grade in muscle pH as well as in colors a and L. The results of this experiment confirm that the feeding strategy used can in fact influence the quality of meat by altering the pH and color (a,L).

Table 1. Means for the colours a, b and L, meat pHu, water-holding capacity (WHC), pH and percentage cooking loss (CLoss) and shear force (WBSF) of heifer's meat from finishing phase systems, pasture and feedlot.

Systems	Color a	Color b	Color L	pHu	WHC	CLoss	WBSF
Feedlot	16,58 b	3,59 a	34,62 b	5,64 b	72,30 a	33,74 a	7,54 a
Pasture	18,17 a	3,77 a	36,96 a	5,72 a	73,23 a	33,19 a	7,99 a

Means followed by different letters in the same column are different ($P < 0.05$).

Key Words: pasture, feedlot, lipids

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T165 Hypocholestromic effect of turmeric powder and sodium selenite in Ross broilers reared under heat stress conditions. A. Zeinali*¹, A. Riasi¹, H. Farhangfar¹, and H. Ziaei², ¹Birjand University, Birjand, Iran, ²Agricultural Research Center, Birjand, Iran.

An experiment was conducted using 180 Ross broiler chickens to evaluate the effect of different levels of sodium selenite (SS) and turmeric powder (TP) on lipid concentrations of broilers. One-day old chicks were randomly allocated to 6 treatments (T1= control, T2= control + 5 g TP /kg, T3= control + 10 g TP /kg, T4= control + 0.3 mg Se/kg,

T5= control + 0.3 mg Se + 5 g TP/kg, and T6= control + 0.3 mg Se + 10 g TP /kg) with 3 replicates and 10 birds per each replicate. The air temperature was increased (32-35°C) from day 28 to day 42. At 28 and 42 d of age, two birds (one male and one female) of each replicate were randomly selected and blood samples were taken from the wing vein with heparinized syringes. Statistical analysis of data was undertaken using the GLM procedure of SAS. Results showed that the interaction between selenium and turmeric powder resulted in a decrease in plasma cholesterol concentration at 28 days of age ($P < 0.05$). Birds fed the