

1250 (T153) Effect of the inclusion of plant extracts, vitamins and their association on biological efficiency, carcass length, total beef cuts, tissue composition and carcass muscularity of Nellore cattle. M. B. Silva^{*1}, A. M. Jorge², F. D. Resende³, G. R. Siqueira⁴, G. F. Berti⁵, J. M. B. Benatti⁶, C. L. Francisco¹, and D. C. M. Silva¹, ¹Universidade Estadual Paulista-FMVZ, Botucatu, Brazil, ²Faculdade de Medicina Veterinária e Zootecnia, Universidade Estadual Paulista, Botucatu-SP, Brazil, ³Agência Paulista de Tecnologia dos Agronegócios-APTA, Colina, Brazil, ⁴APTA-Polo Regional Alta Mogiana, Colina, Brazil, ⁵Centro Universitário da Fundação Educacional de Barretos, Barretos, Brazil, ⁶Universidade Estadual Paulista-FCAV, Jaboticabal, Brazil.

This study evaluated the effects of four treatments [(C) Control diet including A, D and E vitamin; (V) Control diet plus 50% A, D and E vitamin; (E) Diet including plant extracts; (A) Diet with an association of these two additives (50% A, D and E vitamin + plant extract)] on biological efficiency, carcass length, tissue composition, carcass muscularity and total beef cuts of 56 Nellore (*Bos indicus*) young bulls (+360 kg initial weight and +20 mo of age). The treatments provided the same diet for all animals (85 and 15%, for concentrate and forage, respectively), varying only the inclusion of the different additives. All treatments received monensin (30 mg/kg of concentrate). Animals were individually weighed, blocked by initial body weight, and maintained in individual pens for 105 d (finishing phase; 21 and 84 d, for adaptation and trial period, respectively). At the slaughterhouse, carcasses were identified, cooled for 24 h, and weighed to determine the biological efficiency. Right carcass half was used to calculate total beef cuts. Sample from ninth to 11th ribs (HH section; left carcass half) was obtained to determine tissue composition and carcass muscularity. There was no effect of treatments for carcass traits ($P > 0.10$), and total beef cuts ($P > 0.10$). In conclusion, the inclusion in the diet of plant extracts, vitamins and their associations not affected the carcass characteristics and total beef cuts of Nellore cattle. *Supported by CNPQ/NUTRON.*

Key Words: plant extracts, tissue composition, beef cattle, Nellore

1251 (T154) Pearson's correlation between fatty acid profile and gene expression of transcription factors and lipogenic enzymes in the muscle of young bulls fed soybean or cottonseed, with or without vitamin E. M. M. Ladeira^{*1}, D. M. Oliveira¹, A. Chalfun Junior¹, M. L. Chizzotti², P. D. Teixeira¹, and T. C. Coelho¹, ¹Universidade Federal de Lavras, Brazil, ²Universidade Federal de Viçosa, Brazil.

This study had the objective to evaluate the correlations between mRNA expression of peroxisome proliferator-activated receptor- α (PPAR- α), sterol regulatory element binding protein-1c (SREBP-1c); stearoyl-CoA desaturase-1 (SCD1), acetyl CoA carboxylase (ACC) and fatty acid profile in the muscle of young bulls fed diets containing soybean grain or cottonseed, with or without vitamin E supplementation. Twenty-eight Red North young bulls with an average age of 20 mo and initial average live weight of 339 +15 kg were allotted in a completely randomized design using a 2 \times 2 factorial arrangement. The animals were slaughtered at an average weight of 456 \pm 15.1 kg ($P > 0.05$), and two samples were then taken from the longissimus dorsi (LD) muscle of each animal between the 12th and 13th ribs. The first sample was stored at -20°C for subsequent lipid extraction and fatty acid analysis using gas chromatography; and the second sample was stored at -80°C for quantitative gene expression analysis by RT-qPCR. After analyzes of fatty acid content and relative gene expression according to the diets, data of all treatments were used to carry out the Pearson's correlation study using the PROC CORR tool of SAS 9.3. Linoleic acid content was negatively (-0.38; $P < 0.05$) and positively (0.38; $P < 0.05$) correlated with expression of PPAR- α and SREBP-1c, respectively. On the other hand, α -linolenic and oleic acids were positively (0.55; $P < 0.01$ and 0.46; $P < 0.05$, respectively) correlated with PPAR- α , showing an agonistic effect of these fatty acids on the nuclear receptor. In addition, correlations between linoleic acid content and expression of SCD1 (0.39; $P < 0.05$) and ACC (-0.38; $P < 0.05$) were observed in the LD muscle. No correlations ($P > 0.05$) between arachidonic acid and the expression of PPAR- α and SREBP-1c were observed. Oleic and palmitoleic acids had positive correlations with ACC mRNA (0.47; $P < 0.05$ and 0.41; $P < 0.05$, respectively), but a negative correlation between stearic acid content and ACC gene expression was observed (-0.38; $P < 0.05$). In conclusion, linoleic acid was the main fatty acid that influenced expressions of PPAR- α , SREBP-1c, SCD1 and ACC. Furthermore, unsaturated fatty acids affect in different ways gene expression of these genes. *Funded by Fapemig, CNPq, Capes, and INCT-CA.*

Key Words: PPAR, SCD, SREBP-1c

1252 (T155) Effect of functional oils and high levels of glycerine in the diet of Purunã bulls finished in a feedlot on fatty acid composition in the Longissimus muscle grilled.

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Bulls were distributed in a complete randomized design by a factorial scheme 2 × 2 to evaluate the effects of the addition of a commercial mixture of functional oils—cashew and castor oil (Essential, Oligo Basics, Paraná, Brazil) and the effects of corn replace by glycerine (800 g of glycerol kg⁻¹) in the diet of Purunã bulls on fatty acids of the *Longissimus* muscle grilled. Thirty-three bulls (206.1 ± 20.0 kg BW, 8 mo old) were allocated in individual pens and distributed into 4 treatments: CON, without glycerine or functional oils; FOL, functional oil (3 g animal⁻¹ d⁻¹); GLY, 203 g kg⁻¹ of glycerine of dry matter; and GFO, 203 g kg⁻¹ of glycerine of dry matter and 3 g animal⁻¹ d⁻¹ of functional oils. The bulls were fed during 252 d a diet with 420 g corn silage, 477 g ground corn, and 103 g soybean meal d⁻¹; or a diet with 420 g corn silage, 203 g glycerol and 150 g soybean meal. All diets were kept isonitrogenous and isoenergetic. The bulls were slaughtered at commercial slaughterhouse with BW of 468 kg (SD 31.53) ± 19 mo old. The carcasses were labeled and chilled for 24 h at 4°C. *Longissimus* muscle samples were taken by complete cross-section between the 12th and 13th ribs and taken to the laboratory and was frozen at -20°C. *Longissimus* muscle samples were sliced into 1-cm-thick steaks 2 h before grilling. Industrial grill was used to samples grilling at 200°C until reaching 75°C internal temperature. Total lipids were extracted using method with a chloroform/methanol mixture. Fatty acid methyl esters (FAME) were prepared by triacylglycerol methylation according ISO-R-5509 (1978). Then, the esters were extracted with 2 mL of n-heptane and stored at -18°C for later chromatographic analysis (Thermo 3300 gas chromatograph). Retention times and peak area percentages were automatically computed with Chronquest 5.0 software. The fatty acids composition in the *Longissimus* muscle grilled were similar ($P > 0.05$) for bulls fed with functional oils addition. On the other hand in the diet with high level of glycerine the fatty acids ($P < 0.05$) pentadecanoic, margaric, *cis*-10-heptadecanoic, oleic, *cis*-vaccenic, and Σ -monounsaturated increase in the *Longissimus* muscle grilled. Whereas the fatty acids 15:1 *n*-9, stearic, docosapentaenoic, Σ -saturated fatty acid and ratio Σ -Omega-6: Σ -Omega-3 had reduction in the *Longissimus* muscle grilled of bulls feed with glycerine.

Key Words: cashew nutshell liquid; castor oil; meat quality

1253 (T156) Effects of dietary rolled barley grain processed by lactic and citric acid on meat quality in feedlot cattle. M. Nematpoor^{*1}, K. Rezayazdi², and M. Dehghan-Banadaky³,
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The objectives of the present study were to evaluate the effects of feeding barley grain steeped in lactic acid and citric acid on meat quality in feedlot cattle. Thirty Holstein male calves (initial BW = 308 ± 22 Kg) were used in a completely randomized design. Data were analyzed by the GLM procedure of SAS and Tukey test used considering 5% probability. Feedlot cattle fed twice daily a total mixed ration containing rolled barley grain (51% in DM) steeped for 48 h in an equal quantity of top water, in 0.5% lactic acid or 1% citric acid. The experiment was conducted with 3 rations and 10 animals in each group. Rations were: 1) Control (with rolled barley), 2) rolled barley treated with citric acid, and 3) rolled barley treated with lactic acid. Calves were stunned and dressed at the abattoir. All samples were collected from the *M. longissimus lumborum* (LL) on the day after slaughter. Measurements were performed on fresh (24 h post mortem) and a steak was sampled from the right LL between the 12th and 13th vertebrae (Canadian grade side). The used of treatments had no effect on yellowness (6.85, 6.08 and 6.50, respectively), cook loss (36.79, 34.80 and 35.77, respectively), WB shear force (5.07, 5.29 and 5.12, respectively), water-holding capacity (2.10, 1.94 and 1.82, respectively) and pH (5.50, 5.41 and 5.33, respectively) in steaks from calves ($P > 0.05$). The lightness (34.79, 35.23 and 35.94, respectively) and the redness (14.13, 15.51 and 15.96 kg respectively) of LL muscle were significantly affected by treatments ($P < 0.05$). Moreover, feeding feedlot cattle barley grain steeped in 0.5% LA was improved meat quality, but was not observed any effect from CAB diets.

Key Words: meat quality, lactic acid, citric acid

1254 (T157) Natural additives in the diet of bulls (Angus vs. Nellore) finished in feedlot: Fatty acids composition. C. A. Fugita*, R. Prado, I. N. D. Prado, F. Zawadzki, C. Eiras, M. Valero, and R. Passetti,
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Natural extracts could be an alternative for the use of antibiotics as growth promoters in animal feed. The objective of this study was to evaluate the effects of the inclusion of natural additives in the diet of bulls finished in feedlots on *Longissimus* muscle fatty acids composition. Forty-eight bulls (Angus vs. Nellore) finished in feedlot during 94 d were used. The experiment was completely randomized and animals were distributed into four treatments: control (CON); essential oils (EOL— addition of 4 g/animal/day of a mix of essential oils from castor bean- *Ricinus communis*- and ca-

shew- *Anacardium occidentale*); Confimax (MAX– addition of 10 g/animal/day of mix of essential oils from oregano- *Origanum vulgare*, castor bean and cashew, and yeast); and yeast (YST– addition of 5 g/animal/day of yeast- *Saccharomyces cerevisiae*). Bulls were an average of 22 mo old and 318 ± 30 kg at the beginning of the trial and were slaughtered with an average of 468 ± 45kg. Roughage:concentrate ratio was 50:50. A variance analysis was performed and a comparison of means was performed using Tukey test at 10% of significance. Most fatty acids in the *Longissimus* muscle were not altered by the inclusion of additives. The myristic acid was higher ($P < 0.10$) in the CON (3.27%) treatment compared to the EOL (2.83%). Palmitic acid was lower ($P < 0.10$) for the YST. Oleic acid was higher ($P < 0.10$) for the YST (41.4%) and lower for MAX (39.0%) treatment. Natural additives had no effect on SFA, MUFA, PUFA, *n*-3, *n*-6, and the ratio between PUFA/SFA and *n*-6/*n*-3. When fatty acids were analysed individually, some differences were found for YST, indicating a healthier meat fatty acid composition profile for this treatment. The used natural additives had mild effects on fatty acid composition of bulls finished in feedlot.

Key Words: animal nutrition, essential oils, meat quality

1255 (T158) Effects of tannins extract addition in to the diet on physicochemical characteristics of meat from finishing bulls. B. O. Lopez^{*1}, M. A. Mariezcurrena¹, M. D. Mariezcurrena¹, and R. Barajas², ¹Universidad Autónoma del Estado de México, Toluca, México, ²FMVZ-Universidad Autónoma de Sinaloa, Culiacan, México.

Meat samples of *Longissimus dorsi* obtained from sixteen finishing bulls (*Bos Taurus x Bos indicus*) were used to determine the effects of effects of tannins extract addition in to the diet on physicochemical characteristics of meat from finishing bulls. Animals were fed during last 70 d in finishing period diets supplemented or not with 0.3% DM of a condensed and hydrolyzable tannins blend. After harvested and 24-h chilling period, loin of left carcass side was cross-sectioned at 12th rib level, and four 2.5-cm thickness steaks were removed from each carcass. Steaks sample were immediately placed in identified plastic bags and were vacuum-sealed and transported to laboratory. One subsample bag was open and used for water retention determinations. The remainder of the bag samples were frozen at -20°C and kept frozen until used for laboratory determination. Samples were slowly defrosted, then bags were opened, and aliquots were taken by duplicate and subjected to next measurements: dry matter (forced-air oven), crude protein (N x 6.25 Kjeldhal), ether extract content, ash (550°C; 3 h), and shear force. Results were analyzed by ANOVA for a completely randomly design, with eight replicates by treatment, carcass was consider as the experimental unit. Water retention capacity was similar ($P = 0.48$) between treatments

(86.7 ± 114%); dry matter content was not affected ($P = 0.39$) by treatments (25.6 ± 308%), crude protein was not altered ($P = 0.48$) by TE addition (20.15 ± 304%), ether extract was similar ($P = 0.19$) across treatments (5.24 ± 1.22%), ash (2.0 ± 114%) was not altered by TE level ($P = 0.20$), shear force tended to increase ($P = 0.07$) in meat samples from TE supplemented cattle (8.88 and 10.21 kg/cm²). Loss by cooking was not different ($P = 0.30$). It is concluded that tannin extract supplementation did not alter substantially physicochemical characteristics of frozen meat from finishing bulls.

Key Words: finishing-bulls, meat, tannin

1256 (T159) Effect of polymorphisms in the DECR1 and LDHB genes on beef color stability. J. D. Neal^{*}, J. W. Buchanan, and R. G. Mateescu, Oklahoma State University, Stillwater.

The mitochondrial 2,4-dienoyl CoA reductase gene (DECR1) encodes an enzyme that is associated with the β-oxidation of polyunsaturated fatty enoyl-CoA esters. The lactate dehydrogenase B gene (LDHB) encodes an enzyme that catalyzes the interconversion of muscle lactate to pyruvate. These enzymes affect the oxidative capacity of muscles and potentially influences meat color stability. Meat color plays a crucial role in customer preference of retail beef cuts, and losses of \$1 billion annually can be attributed to discolored products. This experiment was created to evaluate the influence of polymorphisms in the DECR1 and LDHB genes on beef color stability. A population of 140 beef cattle finished on grain and grass based diets was harvested, and steaks from these animals were evaluated by panel and instrumental means. Measurements were taken every 12 h for 156 h to evaluate the overall appearance of the steaks. Steaks were separated into high, moderate, or low color stability groups. DNA was extracted from individual tissue samples and SNPs within the DECR1 and LDHB genes were identified. Real time polymerase chain reaction (RT-PCR) and High Resolution Melt curve analysis were run on the extracted DNA samples to determine the genotypes of the cattle. A regression analysis was used to test the association between the new SNPs in the DECR1 and LDHB genes and the beef color stability.

Key Words: beef, meat, quality

1257 (T160) Meat quality in yearling bulls fattened in three production systems from Mexican dry tropic. G. Corral-Flores¹, C. Rodríguez-Muela¹, A. Flores-Mariñelarena¹, J. A. Ramírez-Godínez¹, F. S. Solorio², and C. R. Duran^{*2}, ¹Universidad Autónoma de Chihuahua, México, ²Universidad Autónoma de Yucatán, Merida, México.

The objective was to evaluate the effect of the production system and genetic group in carcass measurements in yearling bulls from mexican dry tropic. Forty-eight animals of

two genetic groups (Brahman*Charolais Bh*CH and Brahman*Brown Swiss Bh*BS) were randomly assigned to Intensive Silvopastoral (ISP, $n = 19$), Silvopastoral + Supplementation (ISP+S, $n = 15$) and Feedlot (F, $n = 14$). Animals were harvested in a commercial abattoir when they target $450 \pm \text{kg}$ live weight, to evaluate hot carcass weight (HCW), yield (Y), rib eye area (REA), fat thickness (FT), and marbling score. As well as bromatological (humidity, ash, crude protein, ether extract) and physicochemical characteristics (PH, meat and fat color for L, a*b*). PROC MIXED of SAS was used. Difference was found ($P < 0.05$) for systems, marbling score was higher in F (446.36 ± 31.77), followed by ISP+S (245.7 ± 26.2) and ISP (167.6 ± 26.9). Genetic group was different ($P < 0.05$), in yield better response was in Bh*CH ($58.9 \pm 0.7\%$) than Bh*BS ($57.7 \pm 0.6\%$), as well as REA ($74.0 \pm 2.7 \text{ cm}^2$ vs $66.2 \pm 2.5 \text{ cm}^2$). Cattle fattened in F had DFD meat with highest pH at 48 h postmortem (6.7 ± 0.06), while bulls in ISP+S and ISP were similar ($P > 0.05$) because they were near to normal pH value. In meat color F had lower L, higher a* and b* 36.9 ± 1.1 , 15.9 ± 0.8 and 20.1 ± 0.9), respectively; while ISP+S and ISP had similar values ($P > 0.05$) for fat color as well as protein and humidity. In ash, ISP and ISP+S were similar ($P > 0.05$; $4.0 \pm 0.07\%$ y 4.0 ± 0.07), but they were higher than F ($3.4 \pm 0.08\%$). Ether extract was high in F ($5.76 \pm 0.5\%$) vs. $2.03 \pm 0.4\%$ in ISP+S vs $1.5 \pm 0.4\%$ to ISP. It was concluded that cattle in ISP can produce the same carcass characteristics, nutritional facts than F; however, they have the advantage to produce lean meat. Also, carcass characteristics may be affected by genetic group. Supplementation can improve beef quality related with marbling score.

Key Words: silvopastoral, feedlot, marbling, cattle

1258 (T161) Effect of diet without forage on beef quality in *Bos taurus* and *Bos indicus* young bulls.

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The objective was to evaluate beef quality of finishing young bulls Nellore or Aberdeen Angus fed a whole grain corn diet without roughage (WR, 85% of whole corn and 15% of commercial pellet) or a traditional diet containing 30% of corn silage and 70% of concentrate (30:70). Thirty-six animals with average initial body weight of $381.2 \pm 11.87 \text{ kg}$ were used in a 2×2 factorial design (2 breeds and 2 diets). Both diets had 12.5% crude protein and 2.88 Mcal/kg of ME. Animals were fed for 82 d after a 28-d adaptation period and slaughtered at the end. Samples were taken from the *Longissimus dorsi* muscle between the 12th and 13th ribs for centesimal composition analyses, color (L*, a*, b*), cooking weight loss (CWL) and shear force (SF). The model included the effects of breed, diet, and their interaction and was analyzed using PROC GLM in SAS 9.1. The moisture, ashes, protein, CWL, a*, and b* were not affected by breed and diet. However, Angus bulls showed higher muscle ether extract in WR than Nellore animals. Angus animals showed greater tenderness when compared to Nellore, and WR had a tendency to increase tenderness. Nellore presented a higher brightness (L*) when compared to Angus animals. Angus animals and diet with whole grain corn increased the levels of ether extract, and the use of Angus animals improved meat tenderness.

Key Words: color, shear force, beef

Table 1258. Centesimal composition (%), color (L*, a*, b*), cooking weight loss (CWL), and shear force (SF) of beef from young bulls Nellore and Angus receiving diets with or without roughage

| Attributes | Nellore | | Angus | | SEM | P Value | | |
|-------------------|--------------------|-----------------|-------|-------|------|---------|--------|---------|
| | 30:70 ¹ | WR ² | 30:70 | WR | | Breed | Diet | B*D |
| Moisture (%) | 73.7 | 74.4 | 73.9 | 73.51 | 1.08 | 0.77 | 0.88 | 0.56 |
| Ashes (%) | 1.2 | 1.2 | 1.2 | 1.3 | 0.15 | 0.81 | 0.61 | 0.87 |
| Protein (%) | 17.1 | 16.7 | 17.0 | 17.2 | 0.20 | 0.82 | 0.88 | 0.67 |
| Ether extract (%) | 4.9 | 4.1 | 4.1 | 6.2 | 0.04 | 0.04 | 0.05 | < .0001 |
| CWL(%) | 27.4 | 27.4 | 27.7 | 25.6 | 1.58 | 0.30 | 0.11 | 0.14 |
| SF (Kgf) | 6.0 | 5.8 | 5.8 | 5.2 | 0.47 | 0.05 | 0.07 | 0.41 |
| L* | 49.2 | 48.7 | 48.3 | 47.7 | 0.51 | 0.02 | 0.97 | 0.56 |
| a* | 7.3 | 7.5 | 7.7 | 7.8 | 0.48 | 0.16 | 0.44 | 0.92 |
| b* | 9.7 | 9.5 | 9.4 | 9.2 | 0.42 | 0.1003 | 0.2745 | 0.8556 |

¹Diet containing 30% roughage and 70% concentrate (30:70).

²Diet with 85% corn grain and 15% commercial pellet (Without roughage, WR).

1259 (T162) Prediction of lamb carcass back fat thickness by skin-fold measurement.

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Skinfold measurement is a common method for determining body fat composition and nutritional status in humans for athletic and health goals. Many subjective and objective methods are available for prediction of sheep carcass composition, with more accuracy for automated methods. The objective of this preliminary study was to start the assessment of the use of skin-fold measurement as predictor of lamb carcass composition. The first trial evaluated the use of skinfold measurement to predict carcass back-fat thickness (BF) and rib eye area (REA). Twenty market lambs (29.73 ± 3.15 kg of BW) were chosen randomly at the slaughterhouse floor. Skin-fold measurement (mm) was taken in vivo with a clinical plicometer with sensibility of 2 mm, reading range of 80 mm, and pressure of ± 10 g/mm², including: skin fold on sternal bone (SSF); skin fold on m. *Longissimus* between first and least lumbar vertebra (LSF); skin fold on rump back-fat thickness location (RSF), and average skin fold (ASF), with the three measurements. After slaughter, carcasses were chilled over 24 h at 4°C. Hot and cold carcass weights (HCW and CCW) were recorded. BF and REA were taken in the cold carcass on m. *Longissimus* between 12th and 13th ribs. A stepwise regression was performed with BW, skin-fold measurement, and carcass weights to predict BF and REA. A two-step model was obtained for BF prediction with SSF and HCW ($P < 0.01$). SSF and HCW were responsible for 39.97 and 48.72%, respectively, of BF variation, resulting in a model $R^2 = 0.89$ (RSD = 0.40). A stepwise model for REA used SSF and BF ($P = 0.0847$). SSF and BF had a partial R^2 of 0.34 and 0.29, respectively, which model representing 63% of REA variation. In conclusion, skin-fold measurement can be used to predict lamb carcass BF and REA, and shows potential to be used in the estimation of carcass composition.

Key Words: back-fat prediction, lamb, plicometer

1260 (T163) Carcass traits and meat quality of goat kids supplemented with chromium-methionine.

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The objective of this study was to evaluate the effects of supplementing chromium-methionine (Cr-Met) on carcass traits and meat quality in Mahanadi goat kids. Thirty-two male kids (BW = 22 ± 2 kg, 4 mo of age) were used in a completely randomized design in one of four treatments: 1) control (without Cr), 2) 0.5, 3) 1.0, and 4) 1.5 mg Cr as Cr-Met/animal/d. Diet was formulated to meet the requirements recommended by

NRC with forage (alfalfa and corn silage): concentrate ratio of 30:70 in TMR form. Diets were the same, except for top-dress addition of Cr-Met fed in two equal meals (0700 and 1700 h). Animals were kept in individual pens for 84 d. Kids were slaughtered following the end of trial after 16-h fasting. The area of the ninth, 10th, 11th, 12th and 13th ribs together with the adjoined section of spinal column were used to estimate the amount of bone-free meat, fat and bone in the carcass. The meat, fat and bone were weighed after separation and the bone-free meat component stored at -20°C for the chemical analysis. Physical meat quality parameters (drip loss, DL, pH and Warner-Bratzler shear force, WBS) were investigated on longissimus thoracis (LT) at 24 h after slaughter. Data were analyzed by GLM procedure of SAS 9.1 and Tukey test ($P \leq 0.05$). The muscle, fat, and bone percentages were not affected by Cr-Met ($P > 0.05$). pH, moisture (%), intramuscular fat (%), crude protein content (%) and DL percentage were also not affected by Cr supplementation ($P > 0.05$). Supplemental Cr decreased WBS (6.89, 5.97, 5.60 and 5.83 in control to 4, respectively; $P = 0.07$). These results suggest that supplementation diet with Cr-Met did not influence the carcass traits and meat quality but improved tenderness of LT in Mahabadi goat kids.

Key Words: chromium-methionine, Mahabadi goat kid, tenderness

1261 (T164) Effect of high level of copper on meat quality in Iranian Mahabadi goat kids.

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This study was performed to determine the effects of supplementing high level of copper (Cu) on meat quality in goat kids. Fourteen male kids (BW = 21 ± 2 kg, 4 mo of age) were used in a completely randomized design with two treatments: 1) control (without Cu), and 2) 100 mg Cu as copper sulfate/animal/d. Diet was formulated to meet the requirements recommended by NRC with forage (alfalfa and corn silage): concentrate ratio of 30:70 in TMR form. Diets were the same, except for top-dress addition of Cu-So₄ fed in two equal meals (0700 and 1700 h) and orts were collected before morning meal. Experimental period was 90 d. The end of trial following 16 h fasting kids were weighed and slaughtered. Meat samples were taken from the *Longissimus dorsi* muscle (LDM). Color [lightness (L*), redness (a*) and (b*) yellowness] and Warner-Bratzler shear force (WBS) were measured at 24 h after slaughter. Cooking loss (CL) was determined by weighing the samples before and directly after cooking in a water bath at 70°C for 1 h. Percentage of CL was calculated. Data were analyzed by GLM procedure of SAS 9.1 and adjust Tukey test ($P \leq 0.05$). Addition of Cu failed to significantly affect lightness (L*) and CL percentage ($P > 0.05$). However, Cu supplementation de-

creased WBS (41.31 and 38.00 in control to 2, respectively) but increased redness (a^* : 14.90 and 16.43 for treatment 1 and 2 respectively) and yellowness (b^* : 12.53 and 17.60 for treatment 1 and 2; $P < 0.05$). These results indicated that dietary supplementations of Cu did not influence CL and lightness. Although Cu supplement increased redness, yellowness, and improved tenderness of LDM in Mahabadi goat kids.

Key Words: Mahabadi goat kid, meat quality, lightness

1262 (T165) Effect of fish oil and thyme on meat quality and meat oxidative stability of Mahabadi kids.

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This study was performed to determine the effects of supplementing fish oil and thyme on meat quality and meat oxidative stability in Mahabadi goat kids. For this aim, 28 Mahabadi goat kids (BW = 17.8 ± 2.8 kg, 4 to 5 mo of age) were randomly assigned to four treatments: 1) basal diet (BD), 2) BD + 0.2% thyme essence, 3) BD + 2% fish oil, and 4) BD + 2% fish oil and 0.2% thyme essence (DM basis of concentrate). Diets were formulated to meet the requirements recommended by NRC with forage (alfalfa and corn silage): concentrate ratio of 30:70 in TMR form. Animals were kept in individual pens with self-mangers for 94 d. Kids were weighed and slaughtered at the end of the trial. Meat samples were taken from the *Longissimus dorsi* muscle (LDM). Color [lightness (L^*), redness (a^*), chroma, hue angle, and yellowness (b^*)], cooking loss and drip loss percentage, Warner-Bratzler shear force, and pH of LDM were measured at 24 h after slaughter. Some of the LDM were immediately stored at -20°C for assaying moisture, intermuscular fat and crude protein content. TBARS values were measured at 1 and 2 mo after slaughter. Data were analyzed by GLM procedure of SAS 9.1 and Tukey test ($P \leq 0.05$). Addition of fish oil and thyme failed to significantly effect on redness (a^*), yellowness (b^*), chroma, hue angle, lightness (L^*), pH, moisture (%), intramuscular fat (%), crude protein content (%), Warner-Bratzler shear force, cooking loss, and drip loss percentage of LDM ($P > 0.05$). TBARS values of the LDM were significantly increased as the storage time increased from 1 to 2 mo ($P < 0.05$). It was also found that diets 2 and 4 significantly decreased and diet 3 significantly increased lipid oxidation and the TBARS value

compared with diet 1 at during of storage ($P < 0.05$). The results of this experiment indicated that supplementation of diet with 0.2% thyme essence decreased oxidative stability and improved quality of LDM during refrigerated storage.

Key Words: fish oil, Mahabadi goat kid, thyme essence

1263 (T166) Effect of fish oil and thyme on performance, blood metabolites, meat sensory of Mahabadi kids.

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This study was performed to determine the effects of supplementing fish oil and thyme on performance, blood metabolites and meat sensory in Mahabadi goat kids. For this aim, 28 Mahabadi goat kids (BW = 17.8 ± 2.8 kg, 4 to 5 mo of age) were randomly assigned to four treatments: 1) control (basal diet), 2) 0.2% thyme essence, 3) 2% fish oil, and 4) 2% fish oil + 0.2% thyme essence. Animals were kept in individual pens with self-mangers for 94 d. Diet was formulated to meet the requirements recommended by NRC with forage (alfalfa and corn silage):concentrate ratio of 30:70 in TMR form. For measuring blood metabolites (glucose, triglyceride, cholesterol, high and low density lipoprotein, albumin, total protein and blood urea nitrogen), blood samples were collected every 21 d before morning feeding. Kids were weighed after 14 d of adaptation and at 21-d intervals after feed restriction and slaughtered at the end of the trial. Meat samples were taken from the *Longissimus dorsi* muscle and frozen at -20°C until taste panel evaluation. Feed conversion ratio (FCR) was calculated according to $\text{FCR} = \text{DMI (kg)}/\text{average daily gain (kg)}$. Data were analyzed using PROC MIXED of SAS 9.1. The Tukey test was used for comparison of treatment means. Dry matter intake, average daily gain and feed conversion ratio were not affected by fish oil and thyme essence ($P > 0.05$). Plasma glucose, triglyceride, cholesterol, high and low density lipoprotein, albumin, total protein and blood urea nitrogen were not affected by treatments ($P > 0.05$). Addition of fish oil and thyme failed to significantly affect sensory properties of meat ($P > 0.05$). The results of this experiment indicate that supplementation of goat kid diet with fish oil and thyme did not influence performance, blood metabolites and meat sensory.

Key Words: fish oil, thyme essence, performance