

**284 Subsidy for private storing butter and cream in Hungary.** I. Feher<sup>1</sup>, G. Virag<sup>2</sup>, S. J. Zsarnoczi\*<sup>1</sup>, H. F. Salem<sup>1</sup>, and L. Villanyi<sup>1</sup>, <sup>1</sup>Szent Istvan University, Godollo, Hungary, <sup>2</sup>Agricultural Intervention Centre, Budapest, Hungary.

The aim of the subsidy for private storing at ensuring the adequate butter supply in European Union. After joining to EU also this kind of subsidies will be used in Hungary. The subsidy for private storing could be provided based on the following conditions: 1. for pasteurized cream, which has fat content between 35-80%, 2. for non salted butter made of pasteurized cream or milk in factory permitted by EU and its fat content is 82% at minimum level and its water content is 16% at maximum level, 3. for salted butter made of pasteurized cream or milk in factory permitted by EU and its fat content is 82% at minimum level and its water content is 16% at maximum level. The subsidy is determined by storing cost and possible changing prices of fresh butter and butter-stock. The condition of subsidy for private storing is to make a contract for

## Horse: Equine production & management

**285 Effect of n-3 polyunsaturated fatty acid source on plasma fatty acid profiles of horses.** P. D. Siciliano\*<sup>1</sup>, S. K. Weibel<sup>2</sup>, L. S. Brown<sup>2</sup>, L. K. Warren<sup>1</sup>, T. E. Engle<sup>1</sup>, and P. D. Burns<sup>1</sup>, <sup>1</sup>Colorado State University, Fort Collins, CO/USA, <sup>2</sup>United Feeds, Inc., Sheridan, IN/USA.

Eighteen mature geldings of American Quarter Horse, Arabian, and Thoroughbred breeding, with an average body weight of 569 ± 8 kg were randomly assigned to one of three dietary treatments, control (CTRL, n = 6), ground whole flaxseed (FS, n = 6) or protected n-3 polyunsaturated fatty acid source (PFA, n = 6; United Feeds, Inc., Sheridan, IN, USA) to determine the effect of n-3 fatty acid source on plasma fatty acid profiles. All horses were group-fed brome grass hay ad libitum. All horses were individually fed 0.8 kg as-fed of a vitamin mineral supplement top-dressed with 0.57 kg as-fed of their respective dietary treatment, daily. The total n-3 fatty acid concentration of the top-dressed supplements, calculated as the sum of C18:3n-3, C20:5n-3, and C22:6n-3, was 0.47, 5.56 and 5.02 g/100g diet as-fed for CTRL, FS and PFA, respectively. Experimental diets were fed for a period of 28 d. Blood samples were collected on d 0, 14, and 28 by jugular venipuncture, and plasma was harvested and analyzed for fatty acid composition. The individual plasma fatty acids C16:0, C16:1n-7, C18:0, C18:1n-9, the sum of C18:2n-6 and n-9, C18:3n-3, C20:0, C20:4n-6, C20:5n-3, C22:5n-3, and C22:6n-3 were expressed as a percent of the total plasma fatty acids. The percent total n-3 fatty acid composition of plasma was calculated as the sum of the percentages of total plasma fatty acids for C18:3n-3, C20:5n-3, C22:5n-3, C22:6n-3. Data were analyzed as a repeated measures design using the PROC MIXED ANOVA procedure of SAS. Mean plasma C20:4n-6, C20:5n-3, C22:6n-3, and total n-3 fatty acids in horses fed PFA increased from d 0 to 14 ( $P < 0.01$ ), and then remained unchanged from d 14 to 28 resulting in greater ( $P < 0.01$ ) proportions of these fatty acids on d 14 and 28 in PFA as compared to FS and CTRL (treatment x time;  $P < 0.015$ ). These results suggest that supplemental PFA increased the proportion of n-3 fatty acids in plasma of horses, whereas a similar amount of n-3 fatty acids provided by ground whole flax seed did not.

**Key Words:** Horse, Polyunsaturated fatty acids, Flax seed

**286 Development of a Model for Treating Insulin Resistance in Mares.** M. M. Vick\*, D. R. Sessions, S. E. Reedy, B. A. Murphy, E. L. Kennedy, and B. P. Fitzgerald, University of Kentucky, Lexington KY.

Obesity in mares is associated with insulin resistance (IR), which in turn may predispose them to laminitis and other inflammatory disease states. In obese humans, biguanides are a family of drugs that have been successfully used to treat IR. The goal of this study was to test the hypothesis that in the horse, dietary-induced insulin resistance can be alleviated by treatment with the biguanide, metformin. Fourteen mares (body condition score 5-7) were maintained at pasture and supplemented with .75 kg mixed grain and corn oil per day (2.64Mcal/kg) for a period of two months to increase obesity and induce insulin resistance. IR was determined by hyperinsulinemic euglycemic clamp procedure. All mares were considered insulin resistant based on low glucose infusion rates during the clamp procedure. Subsequently, the mares

storing based on decided demands with Agency of Payment belonging to state member, in areas of which butter and cream are stored. The subsidy can be claimed in writing form from Agency of Payment for butter and cream having been stored between 15th of March and 15th of August in given year. The application for subsidy should be sent to Agency of Payment, when products have arrived to store within 28 days. The contract for storing is signed, when the application has received at Agency within 30 days. The contracting party or person responsible for storing should keep a record of products stored relevant to contract. In case of contract for private storing the storing period extends between 90 and 210 days. If the contracting party does not keep the deadline, the subsidy will be decreased by 15% and be payed only for that period, when butter and cream were really stored.

**Key Words:** Subsidy for private storing, Pasteurized cream, Contract for private storing

were allocated to control (n=7) and treatment (n=7) groups that were balanced for body weight, body condition, and degree of IR. Metformin hydrochloride was tested at three dose levels (1.5, 3.0, and 4.5g PO, x2 daily). Each dose was tested for successive periods of 30 days, beginning June 1st. Peripheral insulin sensitivity was determined by the clamp procedure at the end of each 30-day interval. Additionally, blood samples were collected x3 per week and body weight and percent body fat were determined at 3-week intervals. Treatment with metformin (1.5g x2/day) was associated with increased insulin sensitivity compared to untreated mares ( $P < 0.05$ ). The highest dose (4.5g) was unaccompanied by increased insulin sensitivity. At a dose of 3.0g, insulin sensitivity was greater than pretreatment ( $P < 0.05$ ) and accompanied by reduced fasting insulin concentrations; however, the degree of sensitivity was not different from that observed in untreated mares. In conclusion, observations from this preliminary study suggest that treatment of obese, insulin resistant mares with metformin may lead to increased insulin sensitivity. This effect may be dose dependent since only lower doses appeared to be effective.

**Key Words:** Metformin, Insulin resistance

**287 Factors associated with mare reproductive loss syndrome in central Kentucky and surrounding areas.** S. L. Gray\*<sup>1</sup>, D. L. Cross<sup>1</sup>, K. E. Panter<sup>2</sup>, W. C. Bridges<sup>1</sup>, and T. Gimenez<sup>1</sup>, <sup>1</sup>Clemson University, Clemson, SC, <sup>2</sup>USDA Poisonous Plants Research Lab, Logan, UT.

On 10 May 2001, a study of the Mare Reproductive Loss Syndrome (MRLS) reported in Central Kentucky and surrounding areas was initiated. This syndrome caused several thousand mares in this area to abort many early-term and a few late-term foals. The mares showed few signs of toxicity. Thirty-eight pastures on 11 farms were studied. Pastures were divided into two groups; those with early fetal losses (Treatment), and those without losses (Control). Overall botanical composition of pastures was evaluated. Chi square analysis of the botanical data showed a relationship between the evidence of consumption ( $p < 0.0001$ ) of Poison Hemlock (*Conium maculatum*) in problem pastures and MRLS. Subsequent chemical analysis determined that the Poison Hemlock plants contained 0.8-1.0% piperidine alkaloids that are known to be toxic to animals. To study the clinical response to *Conium maculatum* in gravid mares, 14 mares were bred for experimental study. At gestational age 45 days, mares were randomly assigned to one of three groups: (1) Control-received no *Conium*; (2) Low (L)-received *Conium* at an alkaloid titration of 2.8mg/kg body weight; (3) High (H)-received *Conium* at an alkaloid titration of 4.3mg/kg body weight. *Conium maculatum* slurry was administered once per day for 4 days. Foals were observed by transrectal ultrasound. Mares were physically examined and blood samples were collected at times 0h, 1h, 2h, 3h, 4h, 5h, 6h, 24h, 25h, 48h, 49h, 72h, and 73h. Blood samples were analyzed for piperidine alkaloid concentrations, blood chemistry components, and progesterone levels. Compared to the control mares, the H mares expressed decreased body weight, higher pulse and respiration rates, more ataxia, colic, salivation, and sweating ( $p < .05$ ). The H and L groups both showed increased frequencies of incoordination and tremors

( $p < .05$ ). One abortion in the H group was detected 19 days following the first dose. Assay results from piperidinic alkaloid tests are pending.

**Key Words:** MRLS, *Conium maculatum*

**288 Effects of feeding endophyte-infected tall fescue diets on embryo survival in mares during early gestation.** R. C. Youngblood\*<sup>1</sup>, B. J. Rude<sup>1</sup>, D. L. Christiansen<sup>1</sup>, N. M. Filipov<sup>1</sup>, R. Hopper<sup>1</sup>, N. S. Hill<sup>2</sup>, B. P. Fitzgerald<sup>3</sup>, and P. L. Ryan, <sup>1</sup>Mississippi State University, Mississippi State, MS, <sup>2</sup>University of Georgia, Athens, GA, <sup>3</sup>University of Kentucky, Lexington, KY.

A high incidence of early embryonic death and spontaneous late-term abortions occurred in Kentucky and neighboring states in spring 2001 and 2002. The objective of this study was to evaluate the embryotoxic potential of feeding endophyte-infected tall fescue seed and hay to mares during early gestation. Mares ( $n = 12$ ) were matched by stage of gestation (d 60-100) and assigned to diets (6/diet) that were fed for 10 days. Diets consisted of endophyte-free (E-) or endophyte-infected (E+); 271 ppb ergot alkaloid content equivalent to 1.36  $\mu\text{g}/\text{kg}$  BW/day tall fescue seed (0.5% BW) mixed with sweet feed (10% CP) as well as ad libitum access to E+ tall fescue or ryegrass hay, for E+ and E- treatments, respectively. Rectal temperatures (RT), blood samples and urine

was collected daily. Blood and serum was analyzed for clinical chemistry, progesterone (P4), prolactin (PRL), and 3-4-dihydroxyphenylacetic acid (DOPAC, a catecholamine metabolite) analyses, whereas urine was analyzed for ergot alkaloids. Also, fetal heartbeat and presence of echogenic material in fetal fluids was monitored daily by ultrasonography (US). RT (E+ 37.76 0.03; E- 37.84 0.03 C) and PRL (E+ 14.06 0.76; E- 12.11 0.76 ng/ml) serum concentrations were not different between groups. Measuring the change in concentration from d 0 over time, P4 concentrations were not different (E+ -0.64 1.49; E- -0.55 1.47 ng/ml). There was no negative pregnancy outcome and US showed no increase in echogenic material in fetal fluids. There was a rapid and persistent ( $p < .05$ ) decline in DOPAC concentrations in E+ compared with E-mares (2.1 0.14 and 4.4 0.43 ng/ml, respectively). Urinary ergot alkaloid concentration was greater ( $p < 0.01$ ) in E+ compared with E-mares (532.12 52.51 and 13.36 2.67 ng/mg creatinine, respectively). Although no embryo loss was observed during the current study, the elevated concentrations of urinary ergot alkaloids and the depressed endogenous catecholamine activity indicate that prolonged exposure to E+ tall fescue could be detrimental to embryonic development and survival in horses.

**Key Words:** Equine, Ergot alkaloids, Catecholamine

## Meat Science & Muscle Biology: Muscle proteinases and meat quality

**289 The Calpain system and animal agriculture.** D. E. Goll\*, Muscle Biology Group, University of Arizona, Tucson, Arizona 85721.

Even before purification of calpain was first described (Dayton et al., 1976), calpain activity had been linked to postmortem tenderization (Goll et al., 1974). Studies have since established that nearly all (up to 90% or more) of the tenderization that occurs during postmortem storage at 2-4°C is the result of calpain activity. Most convincing are the studies showing that there is nearly no degradation of actin and myosin during storage at 2-4°C even for periods as long as 2-3 weeks postmortem. The major cathepsins in skeletal muscle, cathepsins B, D, and L, all rapidly degrade myosin and actin, whereas the calpains are unique among the known proteolytic enzymes in that they do not degrade either actin or myosin.

There presently are three well-characterized members of the calpain family:  $\mu$ -calpain, a protease that requires 3-50  $\mu\text{M}$   $\text{Ca}^{2+}$  for half-maximal activity;  $\nu$ -calpain, a protease that requires 400-800  $\mu\text{M}$   $\text{Ca}^{2+}$  for half-maximal activity; and calpastatin, a protein that inhibits proteolytic activity of the calpains but of no other protease with which it has been tested.

In addition to its role in postmortem tenderization, evidence indicates that the calpain system is responsible for initiating turnover of the myofibrillar proteins in skeletal muscle. Hence, the calpain system has an important role in muscle protein turnover and the rate and efficiency of skeletal muscle growth. Existing evidence indicates that changes in calpastatin activity are more closely related to postmortem tenderization and rate of muscle growth than changes in calpain activity are. Because skeletal muscle contains sufficient calpain activity to destroy all myofibrillar proteins in the muscle in less than 5 min, future studies should focus on how activity of the calpains is regulated (e.g., via calpastatin, phosphorylation, other?) in postmortem and growing muscle.

Dayton, W.R., Goll, D.E., Zece, M.G., Robson, R.M., and Reville, W.J. (1976) A  $\text{Ca}^{2+}$ -activated protease possibly involved in myofibrillar protein turnover. Purification from porcine muscle. *Biochemistry* 15, 2150-2158.

Goll, D.E., Stromer, M.H., Olson, D.G., Dayton, W.R., Suzuki, A., and Robson, R.M. (1974) The role of myofibrillar proteins in meat tenderness. *Proc. Meat Industry Res. Conf., American Meat Institute Foundation, Arlington, VA.* pp. 75-98.

**290 The influence of calcium metabolism on beef tenderness.** T. A. Walsh\*, R. H. Pritchard, D. M. Wulf, and K. W. Bruns, South Dakota State University, Brookings, SD/USA.

Calpain and calpastatin activity are thought to be the determining factors for meat tenderness, and Ca plays a role in calpain activity. The present theory is to manipulate beef cattle diets to change muscle Ca levels and consequently calpain activity and shear force. To test whether dietary Ca manipulations affect tenderness, Angus steers ( $n=20$ ), from

a single source, were assigned to pairs based on an allotment weight. One steer from each pair was assigned to the control treatment (CO) and the other to the low dietary Ca (LC) treatment. All cattle were fed a typical high grain finishing (0.65% Ca) diet starting at 343 kg BW; dietary restrictions were imposed 113 d later at 561 kg BW. The LC received a 0.24% Ca diet for 14, 21 or 28 d prior to harvest and was returned to the CO diet for one feeding 16 h prior to harvest. Individual performance and carcass data were collected. Post mortem muscle temperature and pH were determined for the *Longissimus dorsi*, *Triceps brachii*, and *Semimembranosus* muscles from each carcass at 1, 3, 6, 24, and 48 h post mortem. Warner-Bratzler shear force was determined on three steaks from each muscle from each carcass, on d 5, 10 and 15 post mortem. There appeared to be no adverse affect on DMI or ADG when fed a LC diet. Serum Ca levels at exsanguination were higher ( $P < 0.01$ ) for LC cattle than CO (11.9 v. 9.3 mg/dL). Muscle pH was higher ( $P < 0.05$ ) for LC at 1 h (6.47 v. 6.25), 3 h (6.16 v. 5.97), 48 h (5.61 v. 5.57) post mortem. Warner-Bratzler shear force values did not differ ( $P > 0.2$ ) between treatments on d 5, 10, and 15 for the *Longissimus dorsi* (3.0 kg  $\pm$  0.18) and *Triceps brachii* (3.1 kg  $\pm$  0.15). Shear force was lower ( $P < 0.05$ ) for LC on d 5 for the *Semimembranosus* (3.6 v. 4.2 kg). Muscle Ca concentration was numerically higher in the LC than CO (38.6 v. 37.3  $\mu\text{g}/\text{g}$ ). The depletion of Ca from finishing diets did not appear to have adverse affects on performance, but did increase serum Ca levels and altered muscle pH and shear force values of the *Semimembranosus*.

**Key Words:** Beef, Muscle, Calcium

**291 Influence of early postmortem protein oxidation on beef quality.** L. J. Rowe, K. R. Maddock, A. Asmus, S. M. Lonergan, and E. Huff-Lonergan, Iowa State University.

The objective of this study was to examine the impact of early post-mortem protein oxidation on the color and tenderness of beef steaks. To obtain a range of oxidation levels, both longissimus dorsi et lumborum (LDL) muscles from each of ten beef steers fed a finishing diet with vitamin E (1000 IU per head per day, minimum of 126 d [VITE],  $n = 20$  muscles) and from another ten beef steers fed the same finishing diet without vitamin E (CON diet,  $n = 20$  muscles) were used. Within 24 h after harvest, LDL muscles from each animal were cut into 2.54 cm thick steaks and individually vacuum packaged. Steaks from each animal were assigned to a control group (not irradiated) and an irradiated group (average dose = 6.4 kGy). Steaks were irradiated within 26 h postmortem and were aged at 4°C for 0, 1, 3, 7, and 14 d after irradiation. Steaks from each diet/irradiation/aging time treatment were used to determine color, shear force, and degree of protein oxidation (carbonyl content and sulfhydryl content). Steaks from animals fed VITE diet had significantly higher  $\alpha$ -tocopherol contents than steaks from animals fed the CON diet. At 0 d post-irradiation, within diet,