level of milk production, ration moisture content, environmental temperature, and salt intake. Cows typically spend only 5 to 10 minutes per day drinking water at a rate of 10 to 20 liters per minute (lpm), and inadequate water bowl flow rates could limit water consumption. The objective of our study was to survey water bowl flow rates in tie-stall and stanchion barns, and to investigate whether or not water flow rates may be limiting milk production. Fifty-three dairy farms with tie-stall or stanchion barn housing systems were selected for the study. Herd size average and range were 69 and 32 to 96 milking cows, respectively. Bulk tank milk production per cow per day averaged 30.8 kg with a range of 11.2 to 45.3 kg across the herds. Water flow rates were measured 3x at the water entrance to the barn and at three water bowls located the nearest, middle, and farthest from the entrance on each side of the two-row barns. Bulk tank milk weights, dumped milk weights, and number of cows milked were recorded. Only 46% of the 318 water bowls measured delivered 11 or greater lpm. Water entrance flow rates averaged 2.24 times greater at 26.9 lpm than water bowl flow rates at 12.1 lpm. As herd size and distance from water entrance increased, water flow rates declined from 12.6 to 11.0 lpm. No difference ($P > 0.10$) in milk production between high and low water flow rate herds was observed. Most herds had supplemental water available during daily release for cow exercise and barn cleaning which seemed to negate any adverse effects of insufficient water intake on milk production. Thirteen of the 53 dairy farms had variable water bowl flow rates both below 3.8 and higher than 11.3 lpm, suggesting that water bowl maintenance was an issue on about a quarter of the dairy farms surveyed.

Acknowledgements: Appreciation is extended to Tom Anderson, Matt Glewen, and Zen Miller for assistance with on-farm data collection.

Key Words: Water, Flow rate, Dairy cows

Growth and Development: Growth, Diet and Performance

M64 Performance of Holstein and Jersey calves compared with performance of Jersey × Holstein and Holstein × Jersey crossbred calves. J. V. Ware*[1], S. T. Franklin[1], A. J. McAllister[1], J. A. Jackson[1], and B. G. Cassell[2], [1]*University of Kentucky*, *Lexington*, [2]*Virginia Polytechnic Institute and State University*, *Blacksburg*.

The objective of this study was to compare differences in performance among purebred and crossbred calves. Holstein and Jersey cows were bred using mixed semen, resulting in treatment groups of Holstein × Holstein (HH), Jersey × Jersey (JJ), Holstein × Jersey (HJ), and Jersey × Holstein (JH) calves. Calves (n = 68) were removed from their dams prior to nursing, weighed, and fed pooled colostrum, at approximately 5% of birth weight, within 3 h of birth. Calves received pooled colostrum again 12 h later. Calves were moved to individual hutches and fed milk at approximately 5% of body weight twice daily. Water and a starter ration were provided beginning on d 3. Milk and starter intakes were recorded daily. Body weights were obtained weekly through 8 wk. Hip heights were obtained within 48 h after birth and at 6 wk of age. Calves were weaned after consuming starter at greater than or equal to 1% of their body weight for three consecutive days. Mean weekly dry matter intakes (total of milk and starter) were lowest ($P < 0.05$) for JJ (4.9 ± 0.5 kg) but not differ among HH, HJ, and JH (7.0 ± 0.3, 6.8 ± 0.3, and 6.1 ± 0.3 kg, respectively). Mean weekly body weights were greatest ($P < 0.05$) for HH (57.5 ± 0.9 kg) and lowest for JJ (37.5 ± 1.6 kg) with HJ and JH intermediate (49.3 ± 1.1 and 47.0 ± 1.2 kg, respectively). Gain through 56 d was greater ($P < 0.05$) for HH (35.7 ± 0.8 kg) and HJ (34.5 ± 0.8 kg) compared to JJ (24.9 ± 0.8 kg). Gain for JH (29.8 ± 0.8 kg) was intermediate and did not differ ($P > 0.05$) from HJ or JJ. As a percent of birth weight, gains for HH (96.5 ± 2.2 %) and HJ (95.4 ± 2.2 %) were greater ($P < 0.05$) than for JJ (68.6 ± 2.2 %). Percent gains for JH did not differ ($P > 0.05$) from the other treatments. Hip heights did not differ ($P > 0.05$) among HH, HJ, and JH (mean = 0.82 ± 0.01 m) but were lower ($P < 0.05$) for JJ (0.78 ± 0.01 m). In conclusion, HJ calves had the ability to perform in a comparable manner to HH calves.

Key Words: Calves, Crossbred, Dairy

M65 The effect of feeding three milk replacer regimens preweaning on first lactation performance of Holstein dairy cattle. C. Ballard*[1], H. Wolford[1], T. Sato[2], K. Uchida[2], M. Suekawa[2], Y. Yabuuchi[2], and K. Kobayashi[2], [1]*W.H. Miner Agricultural Research Institute*, *Chazy, NY*, [2]*Zen-Noh National Federation of Agricultural Co-operative Associations*, *Tokyo, Japan*.

As previously reported, sixty Holstein heifer calves at two farms were blocked at birth and randomly assigned to one of three milk replacer (MR) treatments formulated on DM basis: 1) 27% CP/20% Fat fed at 1.5% BW for first week, 2.25% BW from 8 days through 5 weeks, and 1.25% BW from 6 weeks to weaning; 2) 27% CP/20% Fat fed at 200g 2x/day for 2 weeks, 250g 2x/day through weaning; or 3) 27% CP/15% Fat fed at 1.5% BW for first week, 2.25% BW from 8 days through 5 weeks, and 1.25% BW from 6 weeks to weaning. The objective of this study was to measure growth and performance of heifers from 18 months of age through their first lactation. Data was analyzed using Proc GLM with farm and block(farm) in the model. No treatment differences were found for weight and stature of animals at 30 mos of age (n=14, 18, 19). No significant difference in age or weight at calving was realized, although heifers fed milk replacer at a fixed rate tended to be younger and weigh less. Incidence of retained placenta and postpartum metabolic disorders were similar for all treatments. Heifers also had similar calving ease scores with 79, 78 and 68%, respectively having easy calving scores of 1 and 2. No difference in milk yield was realized at 100 dim. Heifers fed the 27/20 MR as a % of body weight yielded nearly 700 kg more milk than treatments 2 or 3 at 200 dim (n=14,18,19). Milkfat and protein yield was similar for all treatments. Although not significant, 3.5%FCM yield at 200 dim tended to be higher for 27/20 MR heifers fed as a % of BW. Implementation of enhanced early nutrition programs may positively impact first lactation milk yield.

	Treatment				
Item	1	2	3	SEM	*P*
Wt, kg Mo 30	653.96	648.68	672.05	18.96	0.511
WH[1], Mo 30	143.10	142.17	142.63	0.75	0.694
S-P[2], Mo 30	176.86	175.25	177.49	1.46	0.494
Age at Calving, d	796	753	783	16	0.264
Wt at Calving, kg	670.60	630.02	666.01	15.52	0.118
Milk-200d					
Yield, kg	6803[a]	6014[b]	6154[b]	206	0.036
Fat, kg	254	229	231	10	0.757
Protein, kg	200	175	184	7	0.530
3.5FCM, kg	7066	6316	6400	249	0.104

[1]Wither height, cm, [2]Shoulder to pin, cm, [a,b]Means within a row differ ($P < 0.05$).

Key Words: Milk Replacer, Heifer Growth, Lactation

M66 Improved prediction of retained energy in a dynamic beef cattle growth and composition model accounting for variable maintenance. L. G. Barioni*[2], J. W. Oltjen[1], and R. D. Sainz[1], [1]*University of California*, *Davis*, [2]*Embrapa Cerrados*, *Planaltina, DF, Brazil*.

Animal growth and composition models base their predictions on estimated retained energy. Therefore, variation in maintenance requirements related to

previous nutrition and animal state should be accounted for. In this study, the Davis Growth Model (Oltjen et al., 1986, J. Anim. Sci. 62:86) was re-parameterized using data from an independent experiment (Sainz et al., 1995, J. Anim Sci. 73:2971). The dataset contains measurements of diet energy concentration, dry matter intake, and initial and final body composition for 110 animals. Steers were fed one of two diets. During the growing phase, the low-concentrate diet (ME = 1.87 Mcal/kg) was available ad libitum (FA) and the high concentrate diet (ME = 3.06 Mcal/kg) was either available ad libitum (CA) or was limited (CL) to match the weight gains by the FA group. During the finishing phase, steers were fed the high concentrate diet, either for ad libitum intake (CA) or restricted to 70% ad libitum intake (CL). Thus the treatments included just a growing phase CA, CL, FA or both growing and finishing (CA-CA, CL-CA, CL-CL, FA-CA, and FA-CL). The model parameters for maintenance requirement (α) and protein synthesis (k2) were fitted simultaneously to the data by minimizing the error sum of squares of body protein plus the error sum of squares of body energy, weighted according to the respective experimental variances. When including data from all treatments, α converged to 0.1171 Mcal/kg$^{0.75}$ (EBW basis). When estimated for each treatment, α varied as follows: for the first period, α_{CA} = 0.0882; α_{CL} = 0.1112; α_{FA}= 0.1085; and for the final period, $\alpha_{CA\text{-}CA}$ = 0.1063; $\alpha_{CL\text{-}CA}$ = 0.1120; $\alpha_{CL\text{-}CL}$ = 0.1107; $\alpha_{FA\text{-}CA}$ = 0.1363; $\alpha_{FA\text{-}CL}$ = 0.1210 MCal/kg$^{0.75}$. Root mean square error of prediction (RMSEP) was reduced from 191.9 to 148.1 Mcal for retained energy, and from 19.6 to15.8 kg for final body fat when maintenance was adjusted for each treatment. These results indicate that accounting for variable maintenance can significantly improve predictions in dynamic models of beef cattle growth and body composition.

Acknowledgements: Supported by CAPES, Brazil

Key Words: Beef Cattle, Growth, Maintenance

M67 Comparison of modern commercial and low cholesterol swine crosses on performance characteristics. M. J. Anderson*, J. W. Johnson, J. R. Blanton Jr., and S. W. Kim, *Texas Tech University*, *Lubbock*.

The objective of this study was to create a crossbreed using a low serum cholesterol swine (LC) and a modern commercial swine (M; Camborough-22, PIC) that exceeds or is equal to a straight-line MxM cross in performance. LC was developed through unilateral selection for serum cholesterol at d 56 for three generations and maintained at Texas Tech University. In addition to having lower serum cholesterol (65.5±2.1mg/dL vs. 85.6±2.1 mg/dL) LC is more obese than modern swine. M and LC were bred to form four treatments: offspring from the crosses between M male and M female (MM, n=4), between M male and LC female (MLC, n=4), between LC male and M female (LCM, n=4), and between LC male and LC female (LCLC, n=2), where n=number of pens (4 pigs/pen). Pigs were fed based on a 5 phase (P) feeding program for 140d until they reach 76.1±2.5 kg (P1: 7d; P2: 7d; P3: 17d; P4: 61d; and P5: 24d). Body weight and feed intake were measured every 7d from birth to d-56, and every 14d subsequently. Gain/feed of LCM was greater (P<0.05) than LCLC, whereas it did not differ (P>0.05) from MM and MLC. Regressions fitting the growth of pigs from different breedings were obtained using the REG procedure in SAS. Growth of pigs in LCM was 0.588xD-5.295 (R^2=0.97, P for S<0.0001, P for I<0.0001), MM was 0.519xD-5.019 (R^2=0.94, P for S<0.0001, P for I =0.0001), MLC was 0.489xD-5.408 (R^2=0.93, P for S<0.0001, P for I =0.0001), and LCLC was 0.417xD-4.579 (R^2=0.94, P for S<0.0001, P for I=0.004), where D=day of age, S=slope, and I=intercept. Slopes of regressions were compared using the contrast option in SAS. Slopes of LCM and MM were different (P=0.0016) whereas the slopes of MM and MLC were the same (P=0.2295). Slopes of LCLC and MLC were different (0.0158) as well. The results indicate that the pigs in LCM grew faster than the pigs in MM but the growth of pigs in MM and MLC was the same. The pigs in LCLC grew slowest. Both crossbreeds (LCM and MLC) preformed as well as, or better than the two straight-line crosses (MM and LCLC). Therefore, both of the crossbreeds performed well enough to use for future studies in carcass characteristics.

Key Words: Crossbreeding, Swine, Growth Performance

M68 Dietary *trans*-9, *trans*-11 and *trans*-10, *trans*-12 CLA do not alter growth characteristics in mice. J. W. Perfield II*, S. L. Giesy, D. A. Dwyer, and D. E. Bauman, *Cornell University*, *Ithaca, NY*.

The effects of *trans*-10, *cis*-12 and *cis*-9, *trans*-11 conjugated linoleic acid (CLA) in growing rodent models have been broadly reported. However, the *trans*/*trans* isomers of these fatty acids, the main CLA isomers present in heat-treated sunflower oil, have not been extensively investigated. Therefore, the objective of this study was to investigate the effects of *trans*-10, *trans*-12 and *trans*-9, *trans*-11 CLA in growing mice. To do this we synthesized and purified (> 95%) these CLA isomers in our laboratory. The *trans*-10, *cis*-12 CLA isomer has been shown to affect lipid metabolism in growing mice and it was included as a positive control. Twenty male ICR mice (~16 g) were randomly assigned to one of four groups consisting of the same basal diet supplemented with 1%: 1) corn oil (CO; Control), 2) *trans*-10, *cis*-12 (*t*-10, *c*-12) CLA, 3) *trans*-10, *trans*-12 (*t*-10, *t*-12) CLA, or 4) *trans*-9, *trans*-11 (*t*-9, *t*-11) CLA. Total fat content of the diets was 6%, and mice were fed their respective diets for 4-wk. Data were analyzed using the GLM procedures of SAS and included Tukeys adjustment factor. Growth rate and final body weight did not differ among treatments. The *t*-10, *t*-12, and *t*-9, *t*-11 CLA isomers had no effect on body composition. However, the *t*-10, *c*-12 CLA caused a 14% reduction in empty carcass weight, a 68% decrease in fat content, and increased water and protein content by 9 and 14%, respectively. The *t*-10, *c*-12 CLA treatment also ablated development of the epididymal fat pad, while increasing liver weight by 57%, and liver lipid content by 120% when compared to the other treatments. Hepatic concentrations of *t*-10, *c*-12 CLA, *t*-10, *t*-12 CLA, and *t*-9, *t*-11 CLA were 0.67, 0.28 and 0.31 g/100 g of fatty acids for their respective treatments. In contrast to hepatic tissue, epididymal fat had a greater incorporation of *t*-10, *t*-12 (2.15 g/100 g), and *t*-9, *t*-11 CLA (2.14 g/100 g). Overall, effects of *trans*-10, *cis*-12 CLA on carcass and liver lipids were dramatic while *trans*-10, *trans*-12 and *trans*-9, *trans*-11 CLA had no effects on lipid accretion or growth rate of mice.

Key Words: CLA, Mouse, Lipid Metabolism

M69 Time course of growth factor mRNA expression during differentiation of porcine embryonic myogenic cells. G. Xi*, M. White, M. Hathaway, and W. Dayton, *University of Minnesota*, *St. Paul*.

The IGFs and members of the TGF-beta superfamily regulate proliferation and differentiation of myogenic cells. In this study, we used real-time RT-PCR to explore the time course of IGF-I, IGF-II, IGFBP-2, -3 & -5, IGF-type-I receptor, myostatin and TGF-beta mRNA expression in differentiating porcine embryonic myogenic cell (PEMC) cultures. Creatine phosphokinase activity and myogenin mRNA expression were used to monitor cell differentiation. IGF-I mRNA levels were low in 48 h proliferating PEMC cultures, and increased 5 fold (P < 0.01) during differentiation, reaching a peak at 120 hrs. IGF-II mRNA increased 48% at 72 h (P<0.05) and then decreased 65% by 144 h (P < 0.01). IGF-type-I receptor mRNA levels decreased 43% (P<0.05) between 48 h and 144h in culture. IGFBP-3 mRNA levels were relatively high during proliferation, dropped by 40% (P<0.01) at 72 h, recovered to initial expression levels at 96 h and reached their highest levels at 144 h . This general pattern was also observed using immunolocalization of IGFBP-3 protein in differentiating PEMC cultures with maximal levels detected at 144 h. IGFBP-2 mRNA levels progressively increased throughout differentiation reaching their highest level at 144 h increasing approximately 3.6 fold (p<0.01) compared with initial 48 h levels. Conversely, IGFBP-5 mRNA levels began relatively high and progressively decreased as differentiation progressed, dropping approximately 3.2 fold (p<0.01) compared with levels at 48 h. Measurement of TGF-beta1 and myostatin (GDF-8) mRNA levels during PEMC differentiation revealed that TGF-beta1 mRNA levels decreased 30% (p<0.01) at 96 h, quickly rebounded to a peak level at 120 h, and returned to 48hr levels by 144 h. Interestingly, myostatin mRNA levels decreased dramatically (75%, P<0.01) and remained relatively low throughout the remainder of the differentiation process. Our data demonstrate that these important growth factors are differentially regulated during PEMC differentiation and provide new information about their potential interactions during myogenic differentiation and muscle development in porcine muscle cells.

Key Words: Porcine Myoblasts, Differentiation, Growth Factor Expression

M70 Effect of maternal age at first pregnancy on fetal and placental growth in Columbia and Romanov ewes. P. P. Borowicz*, J. S. Caton, K. A. Vonnahme, M. A. Ward, E. Borowczyk, A. T. Grazul-Bilska, D. A. Redmer, and L. P. Reynolds, *North Dakota State University*, *Fargo*.

Adolescent pregnancy outcome is characterized by low birth weights, high mortality rates and reduced postnatal performance. Intrauterine growth retardation and reduced fetal viability are also correlated with reduced placental development and blood flow, which compromises fetal nutrient and oxygen uptake. In this experiment we investigated effects of maternal age (age at first pregnancy) on placental and fetal size. To obtain genetically similar fetuses we performed embryo transfer. The experimental group was compromised of donor (n = 6) and recipient (n = 24) ewes. Within each breed (Columbia and Romanov) there were 3 donors and 12 recipients (6 yearlings [early adulthood, 1 year and 7 months old] and 6 lambs [peripubertal, 7 months old]). Ewes and lambs were penned separately within a breed and age, and were housed inside under controlled conditions, and complete pellets diets were fed to requirements. Ewes were slaughtered at day 135 and fetal and placental tissues were collected and measured. Fetal and placental weights were greater ($P < 0.05$) for Columbia vs. Romanov; however there was no breed × age interraction for any variable ($P > 0.10$). We observed that despite no significant differences in fetal girth and crown lump length, weights were less ($P < 0.006$) for fetuses from lambs vs. yearlings (4.22 ± 0.40 vs. 4.98 ± 0.42 kg). Differences in placental weights were reflected by reduced fetal placental (cotyledonary; $P < 0.03$) and maternal placental (caruncular; $P < 0.05$) weights in lambs vs. yearlings. As a percentage of fetal weight, fetal heart, kidney, and liver weights were similar in fetuses from lambs vs. yearlings. These data indicate that although maternal age at first pregnancy in the two breeds has a dramatic effect on fetal and placental weight, the effect on fetal organ growth is symmetric indicating smaller but developmentary normal fetuses in lambs compared with yearlings. Supported by NIH grant HL64141 to DAR and LPR.

Key Words: Age, Fetal Growth, Pregnancy

M71 An evaluation of the accuracy of a heart girth tape and the CalfScale® foottape for eetermination of birth weight of newborn dairy calves. E. Vernooy*[1], D. Kelton[1], K. Leslie[1], T. Duffield[1], E. Wilkins[1], and L. Wright[2], [1]*University of Guelph*, *Guelph, ON, Canada*, [2]*Elora Dairy Research Station*, *Elora, ON, Canada*.

Many factors contribute to the survival and growth of newborn dairy calves. Birth weight has become a frequently investigated variable in animal survival and performance models. Recent studies have focused on the ratio between cow weight and calf weight at the time of calving. Since electronic scales are not often accessible in dairy herds, there needs to be a device available to the dairy producers that will accurately measure the birth weight of the calf. The devices that are commercially available rely on the relationship between body size, shape and weight. The currently used tools are tapes that measure the heart girth or the cornonary band circumference. Both of these devices have precalculated conversions to relate circumference to body weight. The accuracy of these measuring tapes for the estimation body weight of newborn calves is not well documented. It was the goal of the present study to determine the correlation between both of these measuring devices and the actual body weight of neonatal calves. In the study, 188 neonatal Holstein calves were weighed with a livestock scale, as well as each of the two measuring devices. The calves ranged from 1 d to 10 d from birth. Age was not corrected for in the analysis. Univariate analysis was conducted to compare each of the devices to the livestock scale. When compared to the livestock scale, the foottape device showed a correlation of 0.2914 (R^2) . On the other hand, when the heart girth was compared to the livestock scale, a correlation of 0.5605 was produced. The present study has demonstrated considerable variability in the accuracy of commercially available measuring devices, and illustrates the need for further examination and analysis of these devices.

Key Words: Measuring Devices, Birthweight, Dairy Calves

M72 Glucose oxidation and lipogenesis in hybrid striped bass fed diets with different starch ratios. S. Rawles*[1], T. G. Gaylord[2], and R. Lochmann[3], [1]*USDA/ARS - H. K. Dupree Stuttgart Nat'l Aquaculture Res. Ctr.*, *Stuttgart, AR*, [2]*USDA/ARS/SGPGR - Hagerman Fish Culture Exp. Sta.*, *Hagerman, ID*, [3]*University of Arkansas - Pine Bluff*, *Pine Bluff*.

Increasing the ratio of amylose (AMY) to amylopectin (PEC) in the diet improves carbohydrate (CHO) use in some mammals. Slower digestion of AMY results in lower glycemic index and lipogenesis and leaner growth. Carnivorous fish may benefit from this strategy since fish do not use CHO well and any increase in dietary inclusion could reduce feed costs. A 7-wk feeding trial with hybrid striped bass (HSB) was conducted using isonitrogenous, isocaloric, semipurified diets containing 25% CHO of increasing AMY:PEC ratio. Liver slices were then incubated with radiotracers ([U-14C]glucose, glc and [3H]palmitate, pal) to determine glc utilization and de novo lipid and triacylglycerol biosynthesis. Hepatic glycogen production decreased with increasing AMY and was 10X lower than the rate of [14C]glc oxidation to CO2 in all treatments. CO2 production accounted for 88 to 96% of total glc utilization and was lowest in fish fed either the GLC diet or the highest amount of AMY (30PEC). Rates of both esterification (from pal) and glyceride formation (from glc) were of similar magnitude as glycogen production and also appeared lowest in fish fed the GLC or 30PEC diets. Trends in glc oxidation, therefore, mirrored trends in lipogenesis and are most likely due to differences in digestion, excretion, and glc sequestering at the cellular level. Concentrations and activities of glc metabolizing enzymes are lowest in fish. Although glc requires no enzymatic digestion, reduced glc phosphorylation results in significant loss via urinary excretion. On the other hand, in vitro glc metabolism and lipogenesis were inversely related to dietary AMY content and also suggests significant CHO loss. High-amylose starch may be resistant to HSB digestion. High rates of CO2 production among all treatments suggest significant oxidation of dietary CHO; however, the tracers used preclude distinction of Krebs vs. pentose cycle CO2. In conclusion, high-amylose diets had minimal positive effects on HSB carbohydrate use.

TABLE 1. Glc utilization and lipogenesis in hybrid striped bass fed different starch ratios[1]

CHO[2]	CO_2	Glycogen	Glyceride	Esterification
100PEC	3390±213 a	249±22 a	149±40 ab	101±10
70PEC	3378±603 a	187±23 b	190±46 a	103±10
30PEC	2511±771 ab	107±26 c	104±34 ab	86±12
GLC	1593±288 b	208±23 ab	65±18 b	75±11

[1]Product nmol/min/mg liver±SE; n=5-6/diet. Letters indicate significant differences (P<0.10) [2]Diet CHO from glucose (GLC); 100% PEC (100PEC); 30% AMY:70% PEC (70PEC); 70% AMY:30% PEC (30PEC)

Key Words: Hybrid Striped Bass, Carbohydrates, Lipogenesis

M73 Allometry of postweaning growth in straightbred and crossbred Botucatu rabbits. E. Bianospino, A. S. A. M. T. Moura*, S. Fernandes, and F. E. Wechsler, *UNESP/ Faculdade de Medicina Veterinária e Zootecnia*, *Botucatu, SP, Brazil*.

The objective was to determine whether there are differences in the allometry coefficients of organs, tissues and commercial carcass cuts between straightbred and crossbred Botucatu rabbits, from weaning up to 91 d of age. A total of 128 rabbits, straightbred Botucatu and Botucatu x White German Giant crossbreds, were involved in a completely randomized design, with a 2 x 2 factorial arrangement (2 genetic groups and 2 sexes) applied to the main plots (cages). Rabbits were weaned at 35 d and sequentially slaughtered at 42, 49, 56, 63, 70, 77, 84, and 91 d of age, four per genetic group x sex combination. The weights of skin, empty gastrointestinal tract, distal parts of fore and hind legs, commercial carcass, head, thoracic viscera, liver, kidneys, spleen, dissectible fat, and of the commercial cuts (fore part, loin and hind part) were measured.

Meat and bone weights were determined for the left hind leg. The log weights of organs, tissues and parts were regressed against the log weights of commercial carcass. No differences in the allometry coefficients between genetic groups or sexes were detected. Skin, empty gastrointestinal tract, distal parts of fore and hind legs, thoracic viscera, liver, kidneys, and spleen had coefficients lower than 1 (0.83, 0.80, 0.59, 0.84, 0.77, 0.55, and 0.22, respectively), indicating that they reached maximum growth during the experimental period. The allometric coefficients of the loin and leg meat were slightly larger than 1 (1.11 and 1.16, respectively), whereas the hind and fore parts presented isometric coefficients (1.03 and 1.05, respectively). The allometric coefficient of dissectible fat was larger than 1 (1.58), whereas the coefficient of bones was smaller than 1 (0.63). There was no indication of maturity differences between the two genetic groups from 35 to 91 d of age. The relative magnitudes of allometry coefficients of organs, tissues and parts will aid in choosing the best slaughter age.

Acknowledgements: This project received financial support from FAPESP, SP, Brazil.

Key Words: Carcass, Growth, Rabbit

M74 Effects of diet and bST on gene expression profile in the liver of heifers. B. J. Lew*[1,2], J. S. Liesman[1], T. E Van Dorp[1], M. D. S. Oliveira[2], S. Sipkovsky[1], and M. J. VandeHaar[1], [1]*Michigan State University*, *East Lansing*, [2]*Sao Paulo State University (UNESP)*, *Jaboticabal, SP, Brazil*.

Our objective was to examine the effect of a high energy-protein diet and bST on the expression of genes involved in growth, development and metabolism in the liver of Holstein heifers shortly after puberty. Liver tissue used was collected in a previous experiment conducted in 1994 (Radcliff et al., 1997) where Holstein heifers were randomly assigned to 1 of 4 treatments - low or high diet (0.8 or 1.2 kg of BW gain/d, respectively), with or without bST administration (25 ug/kg BW/d) - from 120 d of age until the early luteal phase of the fifth estrous cycle. RNA from liver was extracted from 32 heifers (8/treatment), and quality checked using the Agilent Bioanalyzer. RNA was pooled (2/pool), and the 16-pooled samples were examined using a bovine-specific cDNA microarray (National Bovine Functional Genomics Consortium Library) containing 18,263 ESTs. A loop design was used with cDNA samples labeled with Cy3 or Cy5 dyes prior to hybridization. Data was normalized for dye intensity biases using a robust local regression technique (SAS PROC LOESS). Significance levels of differential gene expression among treatments were assessed using a mixed model approach. Independent of diet, bST administration altered the expression of 667 genes while high diet altered the expression of 1187 genes ($P<0.05$). Compared to low diet, high diet without bST, affected expression of 1215 genes ($p<0.05$). bST altered expression of 807 genes in the high diet ($P<0.05$) and 695 genes in low diet ($p<0.05$). Genes altered included several metabolic pathways-related molecules, hormones, growth factors and receptors involved in growth and development. In conclusion, dietary energy and bST administration alter expression of several genes in liver of a dairy heifer, especially genes related to metabolism and growth and development.

Acknowledgements: To CAPES and CNPq for sponsoring first author.

Key Words: Microarray, Liver, Nutrition

M75 Leptin and leptin receptor expression in swine tissues in response to in vivo somatotropin treatment. T Ramsay* and M Richards, *USDA-ARS*, *Beltsville, MD*.

The present study examined the response of the leptin and leptin receptor genes to porcine somatotropin (pST) stimuli in finishing pigs. Twelve crossbred barrows (Yorkshire x Landrace) were individually fed a diet containing 18% CP, 1.2% lysine, and 3.5 Mcal of DE/kg *ad libitum*. At 90 kg, six randomly selected pigs were treated with daily injections of recombinant pST, (10 mg). The other six pigs were injected with bicarbonate buffer (controls). With initiation of pST treatment, the amount of feed offered was at 85% of calculated ad libitum intake, based upon BW and adjusted every 3 d. Diet restriction was performed to correct for the known inhibition in feed intake due to pST treatment in swine. Animals were maintained on treatment for 2 wk with a blood sample obtained on d14. Tissue samples were collected on d15, frozen in liquid nitrogen and stored at -80°C prior to analysis for gene expression by RT-PCR and transcript quantification by capillary electrophoresis with laser-induced fluorescence detection. Samples included outer (OSQ) and middle subcutaneous adipose tissues, leaf fat, liver, latissimus dorsi and biceps femoris. Restricted feeding resulted in no change in bwt of control pigs while pST treatment increased bwt by 6.9 ± 0.5 kg ($p < 0.001$). Treatment with pST produced a twelve-fold increase in serum ST ($p < 0.002$). Serum leptin was elevated by 17% in swine treated with pST ($p < 0.01$). Leptin mRNA level was increased in liver by pST treatment ($p < 0.05$). Leptin receptor (Ob-Rb) expression was reduced 27% by pST administration in liver ($p < 0.04$) and by 49% in OSQ ($p < 0.02$) relative to control animals consuming equivalent amounts of feed. The present data suggest the effect of pST on leptin gene expression in ad libitum fed pigs is primarily the result of pST′s inhibition of feed intake, since the restriction feeding regimen precluded detection of major change in leptin gene expression. Changes in leptin receptor expression by *in vivo* pST treatment suggests a change in sensitivity to leptin in liver and OSQ.

Key Words: Leptin, Somatotropin, Leptin Receptor

M76 Effects of Gammulin® on performance in non-stressed neonatal dairy calves. C. C. Stanley*, C. C. Williams, J. M. Heintz, E. M. Rees, and D. T. Gantt, *LSU AgCenter*, *Baton Rouge, LA*.

Sixteen Holstein calves (8 female, 8 male) were used to determine the feasibility of including bovine serum protein (Gammulin®; American Protein Corp.) in neonatal calf diets in a normal production environment utilizing sound management practices. All calves were removed from their dams, weighed, and placed into individual hutches within 12 h of birth. Calves received 1.9 L of colostrum at each of the first 2 feedings. Beginning on day 2, calves were fed a commercial milk replacer (IBA, Inc., 20% CP; 20% crude fat) once daily. Milk replacer was reconstituted to 21.4% DM and fed at a rate of 10% of initial body weight. At this time, calves were assigned to one of 2 dietary treatments consisting Gammulin® supplementation (60 g/d from days 1-5, 45 g for days 6-10, and 30 g for days 11-15) or no Gammulin® in milk replacer. Gammulin® supplementation was discontinued on day 16. Calves were offered a commercially available calf starter (18% CP; Herd Maker B90 Supreme, Land O'Lakes Farmland Feed, Inc.) and water free choice beginning on day 2. Feed intake and fecal scores were recorded daily for all calves. Body weight was measured on days 7, 16, 23, and 30. Blood and saliva samples were collected at 24 h and on days 7, 16, and 23. Serum was harvested from blood and frozen until samples were analyzed for IgG concentrations with commercially available kits (VMRD, Inc.), and it was determined that all calves had adequate passive immunity. Saliva samples were analyzed for IgA concentrations using commercially available kits (VMRD, Inc.). Although there was a treatment by period interaction ($P < 0.05$), fecal scores for both treatments were not indicative of a problem with scours. There were no treatment effects on average daily gain, grain intake, or IgG concentrations ($P > 0.05$). As expected, grain intake and ADG increased over time during the 30 day trial. Concentrations of salivary IgA were not detectable in any of the samples, and serum IgG concentrations decreased ($P < 0.01$) from 24 h to day 23. These data indicate that Gammulin® supplementation will not improve performance in calves not subjected to stress.

Key Words: Dairy Calves, Gammulin^®^, growth

M77 Blood chemical and plasma amino acid profiles of old versus mature young beef cows. G. Sipe*[1], B. Zanghi[1], G. Wu[2], J. Boling[1], and J. Matthews[1], [1]*University of Kentucky*, *Lexington, KY*, [2]*Texas A&M University*, *College Station, TX*.

To develop an aging cattle model to facilitate future research on age related metabolic function, an initial study was conducted to characterize the influence of age on blood chemical and plasma amino acid profiles of mature young (2-3

yrs old, n = 13, BW = 580 ± 14 kg) versus old (7-12 yrs old, n = 12, BW = 679 ± 24 kg) non-pregnant beef cows of predominantly Angus breeding. All cows grazed the same mixed forage pasture prior to and at the time of blood sampling. Plasma Ala and Gly concentrations (mmol/mL) were 11.5 (P = 0.08) and 20.3% (P = 0.005) lower, respectively, whereas taurine was 22.1% greater (P = 0.01) for old versus young cows. Serum chemistry and blood cell analyses indicated that old cows had lower K^+ (18%, P = 0.01), creatinine (21.6%, P = 0.05), white blood cells (32.2%, P = 0.01), red blood cells (11.2%, P = 0.002), and lymphocytes (16%, P = 0.02) compared to young cows. In contrast, total protein (6.3%, P = 0.005), globulin (9.3%, P = 0.03), total bilirubin (19.3%, P = 0.05), hematocrit (6.2%, P = 0.04), hemoglobin (33.4%, P < 0.0001), and monocytes (29.4%, P = 0.01) were greater in old versus young cows. Serum enzymes, such as Ala aminotransferase (ALT), Asp aminotransferase (AST), and creatine kinase were 22.7, 13.0, and 50.9% lower (P < 0.02), respectively, in old versus young cows, whereas gamma-glutamyl transferase (GGT) was 44.5% greater (P = 0.002). This study has established a baseline for specific blood constituents of the aged versus young mature beef cow and will allow further studies on the ability of geriatric cows to respond to various metabolic challenges, as indicated by alteration of blood constituents.

Key Words: Aging, attle, Amino Acids

M78 The effects of feeding *ad-lib* fresh milk or milk replacer during nursing period on skeletal growth rates of Holstein heifers. U. Moallem*[1], D. Werner[2], H. Lehrer[1], M. Katz[1], L. Livshits[1], I. Bruckental[1], and A. Shamay[1], [1]*Institute of Animal Science, ARO, Israel*, [2]*Extension Service, Ministry of Agriculture, Israel*.

The objective of this study was to compare the effects of feeding *ad-lib* fresh milk vs. commercial milk replacer on skeletal growth and feed efficiency. Forty-six 3 d old Israeli-Holstein calves were individually housed and randomly assigned to one of two treatments: 1) Milk replacer (MR) - calves had free access to milk replacer in two 60-min meals per day fed until 60 d of age and; 2) Milk (M) - calves had free access to fresh milk as in Treatment 1. Calves had free access to water and starter mix and individual feed intakes were recorded until 90 d of age. Both liquid feeds were offered on equal DM basis. Weekly measurements of live body weight (LBW), hip height (HH), withers height (WH), hip width (HW) and heart girth (HG) were taken until 90 d of age. Daily liquid DMI was higher in the MR than the M calves (1.22 vs. 1.11 kg/d; P < 0.0001), but starter mix intake was higher in M group than MR (0.146 vs. 0.126 kg/d; P < 0.01). The total ME and crude protein intakes were significantly higher in the M group than in MR; 5.43 vs. 5.24 Mcal/d (P < 0.01) and 334 vs. 309 g/d (P < 0.0001), respectively. No differences in DMI were observed during the post-weaning period (60 to 90 d of age). At weaning, live body weight (LBW) and hip width (HW) were greater for the M than the MR calves, 81.8 and 76.5 kg, and 27.3 and 26.4 cm, respectively, but no differences were observed in WH, HH and HG. Average daily BW gain during pre-weaning period was 713 and 803 g/d for the MR and M calves, respectively (P < 0.004). At 90 d of age LBW, HH and HW of the M calves were significantly greater than in the MR calves (P < 0.05). Dry matter and ME efficiencies prior to weaning were 0.53 vs. 0.64 kg BW/kg DMI and .136 vs. .147 kg BW/Mcal for MR and M groups, respectively (P < 0.02). In conclusion, feeding *ad-lib* fresh milk compared to milk replacer increased DM and ME efficiencies, increased LBW and HW gain, but had no effect on other skeletal measures.

Key Words: Nursing Management, Skeletal Growth

M79 Effects of in-ovo administration of monoclonal anti-myostatin antibody on post-hatch chicken growth and muscle mass. Y. S. Kim*[1] and H. Y. Jin[2], [1]*University of Hawaii, Honolulu*, [2]*Kangnung National University, Gangnung, Korea*.

Myostatin, a member of the TGF-beta superfamily proteins, is a potent negative regulator for skeletal muscle growth. In this study, we raised a monoclonal anti-myostatin antibody and examined the effects of in-ovo administration of the antibody on post-hatch chicken growth and muscle mass. E. coli-expressed mature form of myostatin was purified by electro-elution of myostatin bands after fractionation by SDS-PAGE, and used as an immunogen in producing monoclonal antibodies against myostatin. One hybridoma clone that showed the strongest affinity to the immunogen in Western blot analysis was used in producing ascites fluid. The monoclonal anti-myostatin antibody (mAb c134) was affinity-purified using a protein A column. The mAb c134 showed in Western blot analysis a strong binding affinity to a commercially available mature myostatin produced in mammalian cell culture system. In a competitive ELISA, the mAb c134 binding to myostatin was inhibited by a commercially available mature myostatin in a dose-dependent manner, demonstrating the binding ability of the mAb c134 to the native form of mature myostatin. When the cross-reactivity of the mAb c134 with some members of TGF-beta superfamily was tested in Western blot analysis, it cross-reacted with rhBMP2, but not with rhTGF-beta3 and pTGF-beta1. To examine the effects of in-ovo administration of the mAb c134, eggs were injected once with 3 μg mAb c134 in 20 μl PBS per embryo into the albumin area on day three after incubation. After hatching, chicks were raised for 24 days. The in-ovo administration of the mAb c134 did not affect either postnatal chicken growth or breast muscle mass. The results of this study indicate that the mAb c134 binds to the native from of mature myostatin, but its ability to inhibit biological activity of myostatin in vivo remains to be further examined.

Acknowledgements: This study was supported by USDA T-STAR grant.

Key Words: Monoclonal Anti-myostatin Antibody, Myostatin, In-ovo Administration

M80 Impact of dietary-lysine restriction in early-finisher on subsequent growth response to dietary lysine level in late-finisher pigs. J. M. DeDecker*[1], M. Ellis[1], B. F. Wolter[2], and B. A. Peterson[1], [1]*University of Illinois, Urbana*, [2]*The Maschhoffs, Inc., Carlyle, IL*.

The effect of lysine restriction in early-finisher pigs (period 1; 69.7 ± 0.90 to 97.4 ± 0.20 kg) on subsequent growth response to dietary-lysine level in late-finisher pigs (period 2; 97.4 ± 0.20 to 129.0 ± 0.35 kg) was evaluated in a randomized complete block design with a 3 × 3 × 2 factorial arrangement of treatments: 1) period 1 digestible lysine (0.35 vs 0.55 vs 0.75%), 2) period 2 digestible lysine (0.60 vs 0.75 vs 0.90%) and 3) sex (barrows vs gilts). Cross-bred pigs (n = 1,620) were housed in a wean-to-finish facility in single-sex groups of 30. In period 1, there were lysine × sex interactions (P < 0.05) for G:F. G:F was lower (3%) for gilts than barrows at 0.60 and 0.75% lysine, but higher (2.5%) at 0.75% lysine. In period 1, increases in lysine resulted in a linear increase (P < 0.001) in ADG (667, 834, and 957 g/d, resp.), a quadratic increase in G:F (0.28, 0.35, and 0.39 g/g, resp.), but no change in ADFI. In period 2, increases in period 1 lysine level resulted in linear decreases (P < 0.001) in ADG (1014, 928, and 898 g/d, resp.) and G:F (0.37, 0.34, and 0.33 g/g, resp.). Increasing period 2 lysine level produced a linear increase in period 2 ADG (P < 0.01; 902, 970, and 967 g/d, resp.) and G:F (P < 0.001; 0.33, 0.35, and 0.36 g/g, resp.) and reduced ADFI (P < 0.05; 2771, 2769, and 2684 g/d, resp.). There was a period 1 × period 2 lysine level interaction (P < 0.01) for G:F. Pigs fed 0.35% lysine in period 1 showed a greater increase in G:F as lysine in period 2 increased than those fed 0.55 and 0.75% lysine in period 1. For the overall growth period (69.7 to 129.0 kg), pigs fed 0.75% lysine in period 1 had greater ADG and G:F than those fed 0.55% which were higher than 0.35% lysine. In summary, lysine restriction in early finisher resulted in increased ADG and G:F in late-finisher but reduced overall growth rate and feed efficiency.

Key Words: Pigs, Lysine, Growth