

to assess nutrition knowledge, determine teaching effectiveness, and to ensure that important concepts were learned. Throughout the presentation, additional questions were asked to determine horse owner hay preferences and collect demographics. Pre-presentation questions demonstrated the lack of horse owner's nutrition knowledge, but provided the ability for the presenter to immediately focus on certain concepts and correct any misconceptions. The survey data showed that a majority of horse owners (69%) bought all of their hay, fed small square bales (57%), and fed a mixture of grass and alfalfa (78%). When asked why participants fed the type of hay they did, 45% indicated they fed what they thought was best for their horse, 42% fed whatever was available, and only 5% had ever worked with an equine nutritionist. A majority of participants (78%) had never had their hay tested for nutritional quality. A majority of participants (72%) owned between one and five horses, 66% were female, 80% were 30 to 69 years old, and 43% had owned horses for less than 5 years. The use of audience response software has resulted in audience participation and interaction, provided immediate feedback regarding teaching effectiveness and participant learning, identified future educational and research needs, and has given insight to horse owner hay preferences and demographics.

Key Words: audience response software, extension, equine

534 Partnering with outside entities to broaden extension's reach: Theory, practice, challenges, implications, and impact. E. A. Greene*¹, R. E. Greene², and R. L. Parsons¹, ¹University of Vermont, Burlington, ²Kleine Lelli Consulting, Wayland.

With decreasing funding, Extension professionals constantly seek innovative means to produce and provide effective programming that demonstrates impact and meets the needs of the clientele. One potential avenue is to partner with strategic community entities to provide mutually beneficial opportunities for all parties involved. Everything Equine, one of New England's largest equine educational events, is a collaboration between University of Vermont Extension, Champlain Valley Exposition, and other equine businesses that combines a consumer trade show with 75 educational seminars/demonstrations over two days. This collaboration provides a measure of program impact and an opportunity to link Extension, 4-H, the community and equine businesses. Due to sponsors and the enormity of this event, Extension clientele are able to learn from national experts, whose normal fees can exceed entire equine extension budgets. Publicity, educational material, volunteer instructor time contributed to Extension for this event is worth more than \$50,000. Commercial exhibitors and equine professionals benefit from interaction with thousands of attendees, while participants benefit from exposure to multiple workshops at one location. For educators, this is a rare opportunity to offer a smorgasbord of educational workshops that would not normally be possible. Extension gains economical and educational benefits while also reaching a large crowd. In 2008, over

8,500 equine enthusiasts attended with at least 1,100 participating in workshops. Calculations indicate that workshops cost less than 40% of traditional Extension workshops, and equine extension received a donation for planning the program. These events have challenges. Partners' roles must be clearly identified and respected by the team and communication is critical. Extension administrators covet monetary benefits but fail to recognize financial risk involved. At such large events, change in behavior can be difficult to measure; we use prize drawings incentives, evaluation cards, and computer surveys.

Key Words: extension, collaboration, programming

535 Maximizing reach via the internet while providing tools for information dissemination in traditional extension environments. E. A. Greene*¹, A. S. Griffin², K. P. Anderson³, and C. D. Skelly⁴, ¹University of Vermont, Burlington, ²University of Kentucky, Lexington, ³University of Nebraska, Lincoln, ⁴Michigan State University, Lansing.

eXtension is an online resource transforming how faculty can collaborate and deliver equine education. As the first Community of Practice launched from eXtension, HorseQuest (HQ) offers free, interactive, peer-reviewed, on-line resources on a variety of equine related topics at www.extension.org. This group has learned how to adapt traditional content to the online environment to maximize Search Engine Optimization (SEO), in order to be more discoverable and relevant in the online world. This means that HQ resources are consistently being found on the first page of search results. Also, by researching keywords searched by Internet users, HQ has guided new content direction and determined potential webcast topics based on relevance and frequency of those searches. In addition to establishing good SEO, HQ has been utilizing the "viral networking" aspect of the popular social network, YouTube™. By uploading clips of existing equine educational videos to YouTube™, HQ content appears in mainstream media, is passed on by the user, and helps HQ effectively reach their community of interest (horse enthusiasts). HorseQuest partners with My Horse University to produce webcasts that combine concise knowledge exchange via a scripted presentation with viewer chat and incoming questions. Locally, multiple specialists have used the 24/7/365 web resource in classrooms and programming throughout their states. Examples include using archived webcasts to bring national talks to local audiences (e.g. Dr. Lenz on The Unwanted Horse), video clips to show digesta moving through the horse's system, or showing examples of equine artificial gaits (e.g. rack), which can be difficult to find. Additionally, animations of the parts of the hoof and the interactive learning lesson for body condition scoring have been used in the field and classroom to supplement presentations. HorseQuest is a resource for several state 4-H advancement and competition programs, and will continue to be incorporated into traditional extension, while reaching and impacting global audiences.

Key Words: eXtension, HorseQuest, social networking

Growth and Development: Fetal Development

536 Inadequate protein levels during gestation in gilts affect gestation body mass and fatness as well as offspring birth weight and insulin sensitivity at 10 wk of age. C.C. Metges*, I.S. Lang, S. Goers, P. Junghans, U. Hennig, B. Stabenow, F. Schneider, W. Otten, and C. Rehfeldt, *Research Institute for the Biology of Farm Animals (FBN), Dummerstorf, MV, Germany.*

We have studied whether maternal gestational protein supply affects glucose metabolism in pig offspring. Isoenergetic diets with low (LP,

6% CP; n=15 sows), high (HP, 30%; n=15) or adequate protein (AP, 12%; n=15) levels were fed to German Landrace gilts (age ≈ 8 mo, 149 kg BW) from insemination to parturition. Gilt gestation BW, backfat thickness (BFT; ultrasound) and offspring birth weight were recorded. Piglets were cross-fostered to control sows (standardized litters, 11 piglets), weaned at 28 d and fed according to recommendations. Two pigs per litter (age ≈ 70 d, ≈ 23 kg, n=10 litters/diet) were fitted with venous and arterial catheters and received an i.v. bolus of 200 mg/

kg BW unlabeled and 1.5 mg/kg BW [U-13C]glucose after overnight food withdrawal. Plasma 13C glucose enrichment was measured by GC-MS. Plasma glucose and insulin concentrations were determined by a glucose kit and by radioimmunoassay, respectively. Areas under the curve (AUC, 30 min) were calculated. Results were evaluated by ANOVA. Gilts fed LP gained less BW until 109 d gestation than in AP and HP (45.6, 67.8, 63.1; $P < 0.05$). During the same time period BFT increased by 3.57, 4.73, and 5.45 mm in HP, LP and AP, respectively ($P < 0.05$). Mean piglet birth weight was lower in LP and HP than in AP (1.19, 1.21, 1.41 kg; $P < 0.01$) with no difference in litter size. The AUC of 13C glucose enrichment and glucose concentration of the offspring did not differ in respect to gestation diet. The AUC of insulin response to i.v. glucose administration was higher in LP and HP offspring as compared to AP (461, 584, 363 $\mu\text{U}/\text{ml} \cdot \text{min}$; $P < 0.1$). This suggests that more insulin was required to metabolize glucose in these groups and LP as well as HP offspring was less insulin sensitive. We conclude that LP and HP diets during gestation are detrimental to growth of the fetuses and metabolism of glucose by the progeny.

Key Words: Fetal programming, swine offspring, glucose metabolism

537 Dam parity influences offspring liveweight and abdominal adiposity. P. R. Kenyon*, H. T. Blair, S. T. Morris, E. C. Firth, and C. W. Rogers, *Massey University, Palmerston North, New Zealand.*

Evidence indicates that the in-utero environment an animal is exposed to, can have long term consequences, with a restricted environment reported to negatively affect an animals physiology, growth and health status. First parity offspring display reduced fetal growth and birthsize, with potentially negative long term consequences. Most studies to date have compared offspring born to differing sires and dams managed separately in pregnancy which result in confounding due to the timing of lambing, dam nutrition and lamb genetics. The present study compared singleton male offspring born to either mature (3-5 years of age) multiparous ($n=20$) or young (8 month) primiparous ($n=17$) ewes bred with the same rams and managed as one cohort during pregnancy and lactation. Offspring born to primiparous dams were lighter ($P < 0.05$) at birth (4.22 ± 0.23 vs. $5.98 \pm 0.22\text{kg}$), 4 months of age (20.38 ± 0.98 vs. $24.90 \pm 0.89\text{kg}$) and tended to be lighter ($P=0.06$) at 10 months of age (40.37 ± 1.41 vs. $44.19 \pm 1.25\text{kg}$) than those born to multiparous dams. At slaughter at 10 months of age offspring born to primiparous dams tended ($P=0.08$) to have lighter carcass weights (18.84 ± 0.80 vs ± 20.10 0.85kg) although there was no difference ($P > 0.10$) in GR or abdominal fat compared to those born to multiparous dams. When adjusted to the same liveweight those born to primiparous dams tended ($P=0.07$) to have more abdominal fat (0.57 ± 0.05 vs. $0.41 \pm 0.05\text{kg}$) compared to those born to multiparous dams. DXA scanning of the hind leg indicated there were no differences ($P > 0.10$) between the groups for bone mineral content, lean or fat mass or the ratio of bone mineral content and lean mass. This study suggests that offspring born to young primiparous dams are programmed to deposit more abdominal fat which could have implications for efficiency of growth and long term health status. Further studies are underway.

Key Words: fetal programming, parity, adiposity

538 Metabolic maturity at birth and neonate lamb survival and growth. I. The effects of maternal low dose dexamethasone treatment at two time points in late gestation. D. R. Miller*¹, R. B. Jackson¹, D.

Blache², and J. R. Roche¹, ¹*Tasmanian Institute of Agricultural Research, Mt Pleasant, TAS, Australia,* ²*University of Western Australia, Perth, WA, Australia.*

Perinatal mortality is a major contributor to reproductive wastage in grazing sheep industries. Maternal glucocorticoid treatment may increase lamb metabolic and endocrine maturity at birth, promoting behavioral competency, thermoregulation, and survival over the first 72 h of life. Multiparous, fine-wool Merino ewes ($n = 150$) were divided into 3 groups to lamb on pasture. Within each group, 5 single-lamb and 5 twin-lamb bearing ewes were randomly allocated to one of 5 treatments. Treatments were either 1.5 or 3.0 mg of dexamethasone (DEX) injected i.m. at either Day 130 or Day 141 of gestation, or 1 ml saline solution injected into half of the relevant ewes at each of these times. DEX had no effect on lamb survival to 72 h after birth ($P > 0.05$); although there tended ($P = 0.09$) to be a lower proportion of treated lambs dying due to dystocia, with heart girth reduced ($P < 0.01$) at the greater dose rate. DEX reduced birth weight by 5% in twin lambs, and reduced pre-suckling rectal temperatures by about 1°C in both twin and female lambs. Treatment at Day 130 produced lambs that took longer to bleat than lambs of untreated ewes ($P < 0.05$), otherwise behavior was unaffected. Treatment at Day 141 increased ($P < 0.05$) pre-suckling plasma ghrelin concentrations in singleton and male lambs but did not alter glucose, NEFA, urea or leptin concentrations or gestation length. DEX did not affect the concentration of plasma metabolites or hormones at weaning, which occurred 78 d after lambing started, or BW recorded 73 d later. In conclusion, maternal glucocorticoid treatment did not have a positive effect on neonate thermoregulation or behavior, or alter perinatal survival. The sensitivity of ghrelin to maternal DEX treatment at Day 141 of gestation warrants further investigation.

Key Words: neonate, dexamethasone, survival

539 Metabolic maturity at birth and neonate lamb survival and growth. II. Association among maternal factors, litter type, lamb birth weight, plasma metabolic and endocrine factors, lamb survival and behavior. D. R. Miller*¹, D. Blache², R. B. Jackson¹, E. Downie¹, and J. R. Roche¹, ¹*Tasmanian Institute of Agricultural Research, Mt Pleasant, TAS, Australia,* ²*University of Western Australia, Perth, WA, Australia.*

Neonate metabolic and endocrine maturity was studied using stepwise multiple regression analysis to explore relationships among litter type, birth weight and ewe nutritional status and lamb endocrinology, physiology, behavior at birth, and survival to 72 h of life. Multiparous, fine-wool Merino ewes ($n = 150$, equal numbers of single and twin lamb bearing status) were lambed on pasture, with low dose dexamethasone treatments applied at d 130 or d 141 of gestation. Improved lamb viability at 72 h after birth ($n = 99$ of 215 born) was related ($P < 0.05$) to increased ewe pre-lambing plasma ghrelin and lower lamb pre-suckling plasma glucose (GLUC) concentration (CONC), lower chill index at birth, greater pre-suckling rectal temperature (RT), singleton litter status, heavier birth weight, and female sex. Greater RT were associated ($P < 0.05$) with increased birth weight and gestation periods shorter than 146 d. Neonate behavioral progress was not related to RT or GLUC CONC, but there was a decline in 72 h survival rates as time to suckle increased. GLUC CONC were greater in singletons, lambs from ewes of high BCS at d 95 of gestation, and lambs of heavier birth weight. GLUC CONC was associated with lower pre-suckling RT; maybe reflecting a delay in GLUC utilization during metabolic rate adjustment to the cold external environment. Singleton lambs had lower plasma NEFA CONC. Birth weight was less in lambs born to ewes with high pre-lambing GLUC

and leptin CONC. Greater pre-suckling ghrelin CONC were measured in lambs from shorter gestations, and when born to ewes with high pre-lambing leptin CONC. Lamb leptin CONC declined with increasing gestational age at birth. In conclusion, lambs exhibiting greater metabolic and endocrine maturity at birth had improved survival to 72 h after birth in a cold environment.

Key Words: neonate, survival, sheep

540 Maternal over-nutrition induces inflammatory response in large intestine of fetal sheep in late gestation. X. Yan*¹, M. Du¹, B. W. Hess¹, S. P. Ford¹, P. W. Nathanielsz^{1,2}, and M. J. Zhu¹, ¹University of Wyoming, Laramie, ²University of Texas Health Sciences Center, San Antonio.

The intestinal mucosal immune system (MIS), which develops largely during the fetal period, plays a key role in defending against potentially pathogenic bacteria. It was hypothesized that maternal over-nutrition induces an inflammatory response in the fetal large intestine which may permanently alters fetal MIS development and, thus, the prevalence of bacteria in their gastrointestinal tract postnatally. Non-pregnant ewes were assigned to a control (Con, 100% of NRC recommendations, n=8) or obesogenic (OB, 150% of NRC, n=8) diet from 60 d before to 135 d after conception, when fetal large intestine was sampled for western blotting and real-time PCR analyses. mRNA expression of Toll-like receptor (TLR) 2 and TLR4 was increased ($P < 0.05$) by $108 \pm 23\%$ and $53 \pm 7\%$ in OB versus Con fetuses. The mRNA level of macrophage markers, CD11b, CD14 and CD68 was also increased ($P < 0.05$) by $75 \pm 42\%$, $69 \pm 17\%$ and $204 \pm 52\%$, respectively. The proinflammatory cytokines TNF α and IL6 were increased ($P < 0.05$) by $91 \pm 33\%$ and $167 \pm 29\%$, respectively. The expression of IL-1 α and IL8 was increased ($P < 0.05$) by $68 \pm 16\%$ and $97 \pm 22\%$, respectively, while IL-1 β tended to increase ($48 \pm 15\%$; $P = 0.06$). Monocyte/macrophage chemotactic protein-1 (MCP-1) was upregulated in the OB group by $30 \pm 13\%$ ($p = 0.05$), and upregulation ($P < 0.05$) of phospho-JNK ($36 \pm 13\%$), pIKK β ($52 \pm 13\%$) and its downstream component p-p65 ($29 \pm 11\%$) was demonstrated in OB versus Con fetuses. In summary, maternal over-nutrition enhances expression of pro-inflammatory cytokines in the fetal large intestine, which may permanently alter MIS development. Since the MIS is responsible for the body defense against opportunistic pathogens, alteration of fetal MIS development in response to maternal over-nutrition may have long-term impacts on offspring health, and the safety of their meat products.

International Animal Agriculture: ASAS-EAAP Global Issues

542 Animal agriculture in developing countries: Population pressures, income growth, climate change, and the management of global genetic resources. D. Gollin*, Williams College, Williamstown, MA.

The UN predicts that world population will rise from 6.5 billion today to 9.1 billion in 2050, with all the increase taking place in today's less developed countries. Among the countries experiencing large absolute increases are some, such as China and India, where incomes are also rising. Taken together, rising populations and incomes will drive up demand for animal products. Projections suggest that meat demand in developing countries could grow by 2.4% annually to 2030, with milk demand rising at 2.7%. Growth in animal agriculture in the developing world will interact significantly with climate change. More animals, raised in more intensive production systems, will add to emissions of

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Key Words: sheep, fetus, gut

541 An in vivo comparison of muscles formed from broiler and layer chick somites. P. E. Mozdziak*, D. Hodgson, and J. N. Petitte, Department of Poultry Science, North Carolina State University, Raleigh.

Unique avian genetic resources at NC State University were employed to test the hypothesis that the embryonic environment has a greater impact on muscle size than the genetic growth potential of muscle-precursor cells. The somites (#17-20; including a portion of the associated neural tube) that form the right *Pectoralis thoracicus* were removed from broiler chick embryos, which are genetically predisposed to form large muscles, and replaced with tissue containing the somites from transgenic, layer strain chick embryos (eGFP or *lacZ*), which are genetically pre-disposed to form small muscles. Broiler somites were also transplanted into a layer background, and broiler somites were also transplanted into a broiler background as a sham control. Subsequently, 18 day embryos were harvested and myofiber diameters were assessed for the left (background) and right (experimental) *Pectoralis thoracicus*. Myofiber cross-sectional area was significantly lower ($P < 0.05$) for layer-derived-muscle (right side; $11.2 \pm 1.0 \mu\text{m}^2$) than the broiler-derived muscle (left side; $19.2 \pm 2.8 \mu\text{m}^2$). However, myofiber cross-sectional area of broiler-derived muscle (right side; $8.8 \pm 1.7 \mu\text{m}^2$) in a layer background was not significantly ($P > 0.05$) different than observed for the layer background muscle (left side; $8.3 \pm 1.1 \mu\text{m}^2$). No significant difference was found between sides when broiler somites were cross-transplanted between broiler embryos ($14.2 \pm 3.5 \mu\text{m}^2$; $15.8 \pm 4.8 \mu\text{m}^2$). Embryos with layer somites were transplanted into a broiler background were cultured through hatching, and chicks were grown to 8 weeks of age. Muscle weights were lower ($P < 0.05$) in the transgenic layer-derived muscle (233 g) than the broiler-derived background muscle (244 g). However, the layer-derived muscles were also larger than expected for un-manipulated layer chicken of the same age. It appears that the *in vivo* environment drives the donor cells to exceed their normal *in vivo* potential, but the donor muscles retain a lower growth potential than the higher growth potential of the host animal.

Key Words: avian, embryo, development

greenhouse gases. Even absent these emissions, the IPCC's projections suggest that mean temperatures will rise by about 1-1.5° C in much of developing Asia and Africa by 2050. Temperature increases will stress traditional crop and livestock systems. Production systems that involve controlling the environment are likely to flourish, taking market share from traditional systems. Thus, intensive production systems seem likely to gain at the expense of backyard production. These trends are likely to have a double effect on animal genetic resources. On the one hand, traditional phenotypes and genotypes may be displaced by the shift towards intensive management systems. On the other hand, the demand for traits associated with tolerance to biotic and abiotic stresses may increase, especially with continued advances in biotechnology. This implies an urgent need to pursue intensive collection and conservation of animal genetic resources. Market forces are unlikely to meet this challenge. On