

determined at Dairyland labs (Arcadia, WI). The pef was calculated as percentage of sample retained above 4.0-mm and 1.18-mm screens for PSPS4mm and Ro-Tap, respectively. The peNDF (%DM) of each sample was calculated as pef x NDF. Dry matter intake, milk yield, and milk protein and fat content were recorded for each herd. The REG procedure of SAS was used to determine the relationship between pef and peNDF estimated using PSPS4mm and Ro-Tap. The Stepwise Selection procedure was used to determine variables that affect herd milk components. The PPS4mm was a good predictor of pef and peNDF in TMR and forages ( $R^2 = 0.93$  and  $0.98$ ; slope =  $0.86$  and  $0.91$ , respectively). For the CS, AS, and TMR samples, average pef estimated with Ro-Tap was (mean  $\pm$  SD)  $87.4 \pm 3.99$ ,  $83.5 \pm 4.34$ , and  $64.3 \pm 6.24$ , respectively, and average pef estimated with PPS4mm was (mean  $\pm$  SD)  $88.4 \pm 4.58$ ,  $87.6 \pm 2.92$ , and  $64.2 \pm 6.35$ , respectively. Significant variables for predicting herd milk fat content were pef, concentrate intake, and milk yield (model  $R^2 = 0.55$ ). Significant variables for predicting milk protein content were pef and forage intake (model  $R^2 = 0.42$ ). The PPS4mm is a useful tool to estimate pef and peNDF of forages and TMR. The pef within and across sample type varied, so estimating pef of individual samples on-farm will allow for more precise formulation of ration peNDF, which affects herd milk components.

**Key Words:** physically effective NDF, Penn State Particle Separator, milk component

**W376 The effects of choice feeding during preweaning period on preweaning and postweaning growth performance of dairy calves.** Mohammad Wakil Hassani and Murat Gorgulu\*, *Cukurova University Agriculture Faculty Department of Animal Science, Adana, Turkey.*

The aim of the study was to investigate the effects of choice feeding in preweaning period on growing performance of calf performance pre and postweaning period. Twenty-eight male and 28 female Holstein calves were used to test 2 feeding systems (TMR, total mixed ration, containing 10% alfalfa hay and choice feeding) and 2 sex (male and female) in a factorial arrangement. Before weaning TMR calves were fed with TMR containing 90% calf starter and 10% alfalfa hay and after weaning all calves were fed with the same TMR containing 50% calf grower and 50% alfalfa hay. Choice fed calves were fed with feed ingredients in TMR ad libitum and simultaneously. The choice fed calves before weaning preferred the diet containing lower alfalfa (10% vs. 5.78%,  $P < 0.05$ ) and barley (52.29% vs. 15.87%,  $P < 0.05$ ), and higher wheat bran (17.28% vs. 30.07%,  $P < 0.05$ ) and SBM (17.73 vs. 45.39%,  $P < 0.05$ ). Sex had no significant effects on diet preferences ( $P > 0.05$ ). Choice feeding increased feed and nutrient intake (protein and fiber) and daily gain significantly ( $P < 0.05$ ). After weaning, sex and feeding system during preweaning period had no effects on any parameters investigated ( $P > 0.05$ ). But sex and feeding system interaction had significant effects on daily gain, feed and nutrient intakes ( $P < 0.05$ ). The male calves fed TMR before weaning consumed more feed and nutrients and had higher daily gain than females but, choice fed calves in both sex had similar daily gain, feed and nutrient intake after weaning. When overall performance were evaluated, male calves had higher daily gain than females ( $P < 0.05$ ). Sex  $\times$  feeding system interaction had significant effects on feed and nutrient intake ( $P < 0.05$ ). The male calves fed with TMR consumed more feed and nutrients than the females ones but this differences disappeared in choice feeding group. In conclusion, the results revealed that choice feeding may improve growth performance of calves by increasing protein intake before weaning and this effect may disappear after weaning. The female calves gave better response to

choice feeding in respect to feed intake. This work was supported by Research Fund of the Cukurova University.

**Key Words:** choice feeding, calf, feeding system

**W377 Effects of day of gestation and feeding regimen in Holstein  $\times$  Gyr cows on apparent total-tract digestibility, nitrogen balance, and fat deposition.** Polyana P. Rotta\*<sup>1,2</sup>, Sebastiao C. Valadares Filho<sup>1</sup>, Terry E. Engle<sup>2</sup>, Luiz Fernando Costa e Silva<sup>1,2</sup>, Marcos I. Marcondes<sup>1</sup>, Fernanda S. Machado<sup>3</sup>, Tathiane R. S. Gionbelli<sup>1</sup>, Breno C. Silva<sup>1</sup>, and Marcos V. C. Pacheco<sup>1</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil <sup>2</sup>Colorado State University, Fort Collins, CO, <sup>3</sup>Embrapa Gado de Leite, Juiz de Fora, Minas Gerais, Brazil.

This study investigated how feeding regimen (FR) alters apparent total-tract digestibility, performance, N balance, excretion of purine derivatives, and fat deposition in Holstein  $\times$  Gyr cows at different days of gestation (DG). Forty-four pregnant multiparous Holstein  $\times$  Gyr cows with an average initial body weight of  $480 \pm 10.1$  kg and an initial age of  $5 \pm 0.5$  yr old were allocated to 1 of 2 FR: ad libitum (AL;  $n = 20$ ) and maintenance level (ML;  $n = 24$ ). Maintenance level was considered to be 1.15% of body weight on a dry matter (DM) basis and met 100% of the energy requirements, whereas AL provided 190% of total net energy requirements. Data for hot and cold carcass dressing, fat deposition, average daily gain, empty body gain, and average daily gain without the gravid uterus were analyzed as a  $4 \times 2$  factorial design. Intake, apparent total-tract digestibility, N balance, urinary concentration of urea, and purine derivatives data were analyzed as repeated measurements taken over the 28-d period. Pregnant cows were slaughtered on 4 different DG: 139, 199, 241, and 268 d. Overall, DM intake decreased as DG increased. This decrease observed in DM intake may be associated with the reduction in ruminal volume caused by the rapid increase in fetal size during late gestation. We observed an interaction for DM and organic matter apparent total-tract digestibility between FR and DG; at 150, 178, and 206 d of gestation, ML-fed cows had greater DM and organic matter apparent total-tract digestibility values than AL-fed cows. Rib fat thickness, mesentery, and kidney, pelvic, and heart fat were greater in AL-fed than in ML-fed cows at all DG, with the exception of rib fat thickness on d 139. Ad libitum-fed cows excreted more N in their feces and urine compared with ML-fed cows. Pregnant cows that were fed at maintenance had greater digestibility during some DG, excreted less N in feces and less N and urea in urine, and deposited less fat in the body. We therefore recommend ML (1.15% of body weight with 93% of roughage) as a FR for pregnant dry cows; however, during the last month of gestation, AL seems to be the most appropriate FR to avoid loss of body weight.

**Key Words:** ad libitum, maintenance, performance

**W378 Effects of day of gestation and feeding regimen in Holstein  $\times$  Gyr cows on maternal and fetal visceral organ mass.** Polyana P. Rotta\*<sup>1,2</sup>, Sebastiao C. Valadares Filho<sup>1</sup>, Terry E. Engle<sup>2</sup>, Luiz Fernando Costa e Silva<sup>1,2</sup>, Marcos I. Marcondes<sup>1</sup>, Mariana M. Campos<sup>3</sup>, Tathiane R. S. Gionbelli<sup>1</sup>, Luis H. R. Silva<sup>1</sup>, Edilane C. Martins<sup>1</sup>, Flavia A. S. Silva<sup>1</sup>, and Faider A. C. Villadiego<sup>1</sup>, <sup>1</sup>Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, <sup>2</sup>Colorado State University, Fort Collins, Colorado, <sup>3</sup>Embrapa Gado de Leite, Juiz de Fora, Minas Gerais, Brazil.

This study investigated the influence of day of gestation (DG) and feeding regimens (FR) on maternal and fetal visceral organ mass in Holstein



× Gyr cows. Forty-four pregnant multiparous Holstein × Gyr cows with an average initial body weight of  $480 \pm 10.1$  kg and an average initial age of  $5 \pm 0.5$  yr were allocated to 1 of 2 FR: ad libitum (AL;  $n = 20$ ) or maintenance level (ML;  $n = 24$ ). Maintenance level was considered to be 1.15% of body weight (dry matter basis) and met 100% of the energy requirements; AL provided 190% of the total net energy requirements. Cows were individually fed a corn silage and concentrate-based diet composed of 93% roughage and 7% concentrate (dry matter basis) as a total mixed ration twice daily. Pregnant cows were slaughtered at 4 DG: 139 ( $n = 11$ ), 199 ( $n = 11$ ), 241 ( $n = 11$ ), and 268 ( $n = 11$ ) d, which was followed by necropsy. Mass of heart, liver, and gastrointestinal tract was greater in AL- than in ML-fed cows. Mammary gland mass was greater in AL- than in ML-fed cows, and the greatest mass was observed at 268 d of gestation. Feeding regimen did not influence fetal body weight in this study. The majority of the visceral organ masses were similar in fetuses from cows fed AL or ML. These data indicate that maternal feed restriction does not affect the development of most fetal organs or fetal development; however, some maternal organs are affected by the FR provided. Moreover, the negative effect on mammary gland mass caused by ML feeding will probably not affect the subsequent lactation because the crude protein concentration in the mammary gland increased with ML feeding. However, we suggest that the AL diet in pregnant dry cows should be provided with caution because the amount of fat in the mammary gland increased at 268 d of gestation.

**Key Words:** fetal development, gastrointestinal tract, mammary gland

**W379 Dietary supplementation of palm- versus high-linoleic safflower oil to mid-lactating Holstein cows: Intake and milk fat yield.** Shahryar Kargar<sup>1</sup>, Clayton M. Stoffel<sup>2</sup>, Lou E. Armentano<sup>3</sup>, and Francisco E. Contreras-Govea<sup>\*3</sup>, <sup>1</sup>Department of Animal Sciences, College of Agriculture, Shiraz University, Shiraz, Iran, <sup>2</sup>Papillon Agricultural Co., Easton, MD, <sup>3</sup>Department of Dairy Science, University of Wisconsin-Madison, Madison, WI.

Cows were fed diets supplemented with either palm oil (PO, rich in C16:0 and C18:1) or high-linoleic safflower oil (SO, rich in C18:2) at 1.5% of dietary DM. Sixty-four primiparous and multiparous cows with an average of  $100 \pm 21.7$  DIM,  $48.6 \pm 10.3$  kg milk yield per d, and  $657 \pm 70.3$  kg body weight at trial initiation were fed the 2 diets for 56 d, after a 2-week covariance period. Thirty-two primiparous and multiparous cows were assigned to one diet, and the other 32 cows to the other diet. The experimental design was a randomized complete block, blocking by parity. Cows were housed in a free-stall barn equipped with roughage intake control system gates (Insentec BV, Marknesse, the Netherlands), which recorded individual cow feed intake continuously. Milk yield was measured daily, and milk composition and cow's body weight were measured weekly. Data were analyzed as a randomized complete block design with diet, parity, week, and interactions as fixed effects, cow as random effect, and week as repeated measurement (SAS Institute, 2003). There was no difference in DMI (26.6 kg/d) and milk yield (46.5 kg/d) between the 2 diets ( $P > 0.05$ ) but feeding PO instead of SO raised milk fat concentration (3.88 vs. 3.55%) and yield (1.79 vs. 1.65 kg/d) ( $P < 0.05$ ), but milk protein yield tended ( $P = 0.10$ ) to increase for PO (1.39 kg/d) than SO (1.36 kg/d). Feeding SO increased *trans*-C18:1 including *trans*-6/8, *trans*-9, *trans*-10, and *trans*-12. For cows fed PO vs. SO, yields of de novo (<16 carbons; 447 vs. 412 g/d) and preformed (>16 carbons; 701 vs. 662 g/d) fatty acids were no difference between the 2 diets. Yield of mixed origin fatty acids (C16:0 + C16:1) increased for cows fed PO (515 vs. 379 g/d), possibly due to less inhibition of endogenous synthesis of C16 when feeding less dietary C18:2; as well as providing more exogenous dietary C16 from palm

oil. These results confirm the greater milk fat depressing effects of oils containing higher concentration of C18:2, as safflower has, relative to a combination of C18:1 and C16:0 as palm oil.

**Key Words:** palm oil, high-linoleic safflower oil, milk fat

**W380 Short- and medium-term changes in glucose metabolism and insulin sensitivity of dairy calves offered different amounts of milk replacer early in life.** Cristina Yunta<sup>1</sup>, Marta Terré<sup>1</sup>, and Alex Bach<sup>\*2,1</sup>, <sup>1</sup>Department of Ruminant Production, IRTA (Institut de Recerca i Tecnologia Agroalimentàries), Caldes de Montbui, Spain, <sup>2</sup>ICREA (Institució Catalana de Recerca i Estudis Avançats), Barcelona, Spain.

The objective of the present study was to evaluate the consequences of 3 allowances of milk replacer (MR) during the first 2 mo of life on short- and medium-term glucose metabolism and insulin sensitivity (IS) of dairy replacement heifers. Forty-five newborn female Holstein calves ( $40.7 \pm 4.94$  kg) after receiving colostrum were randomly allocated to 4, 6, or 8 L/d of MR until 63 d of life ( $n = 15$ ). A glucose tolerance test (GTT) was performed at 42, 86 and 300 d of life. Area under the curve for plasma insulin (IAUC), clearance rates of glucose (CRG) and insulin (CRI), insulin to glucose rate (ItoG), and IS were calculated. Data were analyzed using a mixed-effects model with repeated measures. There were no differences ( $P = 0.67$ ) in CRG among treatments, although they decreased from  $10.1 \pm 0.55\%/min$  at 42 d of age to  $6.7 \pm 0.56\%/min$  at 300 d of age. Interestingly, CRI was greatest ( $P < 0.05$ ) at 42 d of age, and calves fed 8 L/d had the greatest ( $P < 0.05$ ) ICR throughout the study. Insulin release (measured as IAUC) after a GTT increased ( $P < 0.005$ ) with age, and the increase observed between 42 and 300 d of life was more ( $P < 0.05$ ) marked in calves that received 4 (from  $1,000 \pm 234.0$  to  $3,319 \pm 242.7$   $\mu U/mL \times 60$  min) or 6 L/d (from  $1,538 \pm 226.1$  to  $3,887 \pm 242.6$   $\mu U/mL \times 60$  min) than in those receiving 8 L/d (from  $1,735 \pm 226.1$  to  $2,940 \pm 242.6$   $\mu U/mL \times 60$  min). The amount of MR offered had short- and medium-term effects on ItoG, with calves fed 4 and 6 L/d having lower ( $P < 0.05$ ) values ( $145.2 \pm 16.60$   $\mu U/mg$ ) than calves fed 8 L/d ( $215.3 \pm 16.02$   $\mu U/mg$ ) independently of age. Insulin sensitivity tended ( $P = 0.07$ ) to be lesser in calves fed 8 than in calves fed 4 or 6 L/d ( $1.39 \pm 0.04$  vs.  $1.82 \pm 0.05$  mL/min  $\times$   $\mu U/mL$  per kg of BW, respectively). This difference was mainly due to a low IS of calves fed 8 L/d at 42 d, but as age increased, IS tended ( $P = 0.06$ ) to become progressively similar among treatment groups. It is concluded that offering 4 L of MR twice daily elicits a decrease in IS and an increase in ItoG while animals are consuming MR, and the IS returns to normal values over time, but the increase in ItoG is maintained with age.

**Key Words:** calves, enhanced feeding, metabolism

**W381 Energy expenditure in crossbred (Holstein x Gyr) calves differing in phenotypic residual feed intake.** Juliana Mergh Leão<sup>\*1</sup>, Fernanda Samarini Machado<sup>2</sup>, Alexandre Lima Ferreira<sup>2</sup>, Mariana Magalhães Campos<sup>2</sup>, Juliana Campos Carneiro<sup>3</sup>, Paulo Campos Martins<sup>1</sup>, Juliana Aparecida Mello Lima<sup>2</sup>, Thierry Ribeiro Tomich<sup>2</sup>, Luiz Gustavo Ribeiro Pereira<sup>2</sup>, Rayanne Soalheiro de Souza<sup>1</sup>, and Sandra Gesteira Coelho<sup>1</sup>, <sup>1</sup>Universidade Federal de Minas Gerais-UFMG, Belo Horizonte, Minas Gerais, Brazil, <sup>2</sup>Embrapa Dairy Cattle, Juiz de Fora, Minas Gerais, Brazil, <sup>3</sup>Instituto de Ciências Agrárias da UFMG, Montes Claros, Minas Gerais, Brazil.

The aim of this study was to evaluate the energy expenditure in crossbred Holstein-Gyr (F<sub>1</sub>) calves at 50 d of age with different phenotypes for residual feed intake (RFI) by measuring the respiratory gas exchanges





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