

Research Station ALP, Posieux, FR, Switzerland, <sup>2</sup>Research Institute for the Biology of Farm Animals (FBN), Dummerstorf, Germany.

The objectives of the study were to compare energy expenditure (EE) of dairy cows fed grass either on pasture or in the barn and to evaluate the influence of physical activity on EE. Fourteen dairy cows (BW: 658 ± 64.3 kg; milk yield: 45.5 ± 1.78 kg/d) were randomly assigned to a cross over study, with two 2-wk experimental periods consisting of an adaptation and a data collection period of 1 wk each. Cows either grazed on pasture or had ad libitum access to grass from the same paddock, fed in a free-stall barn. All cows were supplemented with a cereal-based concentrate. Milk yield and milk components were recorded daily. In the collection period EE of each cow was determined on 1 d from 0700 to 1300 h using the <sup>13</sup>C bicarbonate dilution technique. After administration of the tracer (0.7 mg NaH<sup>13</sup>CO<sub>3</sub>/kg BW) into the jugular vein, blood was sampled either manually in the barn or with an automatic blood sampling system on pasture. During the same time cow's physical activity was recorded with a pedometer and feeding behavior was investigated using a behavior recorder. Milk (42.8 kg/d), fat (1.58 kg/d) and protein yield (1.31 kg/d) did not differ ( $P > 0.05$ ) between treatments. Within the 6-h measurement period, cows on pasture produced more ( $P < 0.01$ ) CO<sub>2</sub> and consequently expended more energy ( $P < 0.01$ ) than cows fed grass in the barn (251 vs. 204 kJ/kg BW<sup>0.75</sup>). Number of steps was higher ( $P < 0.001$ ) and the proportion of time spent walking (28 vs. 9%) increased ( $P < 0.001$ ) for cows on pasture compared to those in the barn, which, conversely, spent more ( $P < 0.01$ ) time standing (37 vs. 48%). Feeding behavior of the treatment groups changed in such a manner that the proportion of time spent eating (47 vs. 37%) was higher ( $P < 0.001$ ) and that of time spent ruminating (22 vs. 29%) lower ( $P < 0.01$ ) for grazing cows compared to cows fed grass in the barn. In conclusion, positive correlations ( $P < 0.01$ ) between EE and walking ( $r = 0.63$ ) and eating time ( $r = 0.59$ ) suggest that higher physical activity accounts for a considerable part of the higher energy requirements of cows on pasture.

**Key Words:** dairy cows, energy expenditure, pasture

**798 Relationship between milk fat and nutrition in lactating Holstein cows.** M. Vazirigohar\*, A. Nejati Javaremi, and A. Nikkhah, *University of Tehran, Karaj, Tehran, Iran.*

The objective of this study was to evaluate production and nutritional factors that influence milk fat (MF) and milk fat depression (MFD) in lactating Holstein dairy herds. Production data were obtained from the Iranian Dairy Herd Improvement Center (n=33540), which in 2005 and 2006. Programmed total mixed ration (731 herd-month rations) on milk test day were collected from 3 large dairy herds. Diets were evaluated for nutrient composition using CPM Dairy. Milk fat: protein ratio was divided into four different categories (<0.8, 0.8 to 1, 1 to 1.2 and >1.2), which the ratios less than 1 defined as MFD. Data were analyzed with univariate and multivariate regression models. Significant negative ( $p < 0.01$ ; estimate = -0.018) relationship was found between MF concentration and milk yield; MF levels were lower during the summer months and increased as lactation progressed. Milk fat was increased ( $p < 0.01$ ) with dietary levels of forage neutral detergent fiber, effective neutral detergent fiber and sugar contents; it was decreased ( $p < 0.01$ ) with non forage neutral detergent fiber, rumen undegradable protein, and linoleic acid contents. In the ratios lower than 0.8, least squares means of effective neutral detergent fiber, soluble fiber and forage neutral detergent fiber were in the lowest levels (20.81±0.009, 10.43±0.01 and 17.58±0.04 respect.; as %DM), non fibrous carbohydrate, non forage neutral detergent fiber, crude protein, rumen undegradable protein, linoleic acid and

dry matter intake were in the greatest levels (40.58±0.01, 15.35±0.02, 15.69±0.02, 5.99±0.009, 1.62±0.003; as %DM, and 22.41±0.04; as kg of DM). In the ratios of lower than 0.8, least Squares means of milk yield was in the greatest (31.47±0.1 kg) and milk fat percentage was in the lowest (2.15±0.007%) level. This study showed that DMI and linoleic acid were the main factors that influence milk fat depression.

**Key Words:** milk fat depression, nutrition, dairy cows

**799 Profitability and milk yield response to protein supplementation in mid-lactation dairy cows.** A. E. O. Malau-Aduli\* and J. C. Beattie, *School of Agricultural Science, University of Tasmania, Hobart, Tasmania, Australia.*

This study utilized 120 Holstein-Friesian dairy cows in mid-lactation in a randomized block experimental design. The aim was to evaluate milk yield and composition responses to protein supplementation and profitability over an eight-week lactation period. The cows were blocked according to milk yield, days in milk and parity before being randomly assigned to three treatment groups: Control, 15% and 30% protein supplementation. Weekly average daily milk yield (WMY), total milk yield (TMY), income from milk sales, profitability, fat and protein percentages were subjected to statistical analyses to test the effects of treatment, block, parity, week and their second order interactions fitting days in milk as a random effect in mixed model procedures. Multiple regressions with quadratic contrasts were fitted to predict income and profitability from total ration fed and days in milk. The 30% protein supplemented cows gave the highest milk responses (WMY, 27.1 ± 0.80; TMY, 1479.9 ± 38.01 litres), fat percentage (2.6 ± 0.3%), total income (\$597.4 ± 40.23) and profitability (\$54.4 ± 5.04 per cow), while the control group gave the least responses and incurred a loss of -\$24.30 ± 4.95. Third parity cows also gave the highest milk yield responses (WMY, 28.1 ± 0.51; TMY 1562.1 ± 28.24 litres) and profitability (\$65.7 ± 15.37). Residual phenotypic correlations ( $r$ ) between milk yield, composition and profitability were almost all highly significant ( $P < 0.001$ ) with the highest positive  $r = 0.96$  between WMY and TMY. Total ration and days in milk within treatment group alone were very poor predictors of profitability ( $r^2 = 0.02-0.12$ ) compared to within parity groups ( $r^2 = 0.14-0.90$ ) for income, WMY and TMY. It was concluded that even though a positive profit margin was evident, long-term feeding of mid-lactation cows with 30% protein supplement is unrealistic because of the prohibitive cost of protein. Furthermore, protein requirements for milk synthesis at this stage of lactation can be adequately met by a 16-17% protein diet since energy would be the most limiting nutrient.

**Key Words:** protein supplementation, milk yield response, profitability

**800 Pigeon peas as a supplement for lactating dairy cows fed corn silage based diets.** V. A. Corriher\*<sup>1</sup>, G. M. Hill<sup>1</sup>, J. K. Bernard<sup>1</sup>, T. Jenkins<sup>2</sup>, and B. G. Mullinix<sup>1</sup>, <sup>1</sup>University of Georgia, Tifton, <sup>2</sup>Clemson University, Anderson, SC.

Holstein rumen cannulated cows (n=7; initial BW 640.56 ± 71.43 kg) were fed a corn silage basal diet with one of three concentrates (C=control; P10=10% pigeon peas; P20=20% pigeon peas). Cows were randomly assigned to treatments in a replicated 3 × 3 Latin square design and individually fed using Calan<sup>®</sup> gates. Each experimental period was 21 d with 7 d for adaption and 14 d for sample collection. Ruminal fluid samples were taken the last day of each experimental period and analyzed for