**Effects of body condition score on direct and indirect measurements of insulin sensitivity in periparturient dairy cows.**

S. Saed Samii 1, a, J. E. Rico 1,2, b, A. T. Mathews 1, c, A. N. Davis 1, b, C. L. Orndorff 1, b, L. O. Aromeh 1 and J. W. McFadden 1, 2, b.

*1Division of Animal and Nutritional Sciences, West Virginia University, Morgantown, WV, USA*

*2Department of Animal Science, Cornell University, Ithaca, NY, USA*

*a Present address: Animal Nutrition Systems, Chandler, AZ, USA*

*b Present address: Department of Animal Science, Cornell University, Ithaca, NY, USA*

*c Present address: Department of Animal Biology, University of California, Davis, CA, USA*

***animal* journal**

**Supplementary material**

**Supplementary Table S1.** Ingredient and nutrient composition of dairy cow diets.

|  |  |
| --- | --- |
|  | Diets |
| Item | Gestation | Lactation |
| Ingredient (% DM) |  |  |
|  Corn silage | 30.7 | 42.4 |
|  Grass haylage | 28.4 |  7.0 |
|  Grass hay | 13.2 |  2.1 |
|  Dry ground corn | – | 14.4 |
|  Prepartum mix1 | 13.9 | – |
|  Lactation mix A2 | – | 14.0 |
|  Soybean meal | 9.0 |  4.7 |
|  Cottonseed with lint | – |  4.5 |
|  Sugar cane syrup | – |  3.6 |
|  Lactation mix B3 | – |  4.5 |
|  Close-up supplement4 |  4.8 |  2.7 |
|  Rumensin mix5 | – |  0.1 |
| Nutrient composition  |  |  |
|  DM, % | 55.5 | 51.6 |
|  NDF | 48.3 | 37.6 |
|  Forage NDF | 43.7 | 25.1 |
|  Forage NDF, % of NDF | 90.5 | 66.7 |
|  ADF | 32.0 | 25.2 |
|  CP | 12.2 | 16.5 |
|  Starch | 14.1 | 21.2 |
|  Crude fat |  3.16 |  4.33 |
|  Ash |  7.5 |  7.3 |
|  NEl6, Mcal/kg DM |  1.44 | 1.61 |

1Mix contained 27% commercial dry cow mix with Animate (Phibro Animal Health Corp., Teaneck, NJ), 17.3% ground corn, 17.3% crimped oats, 13% corn distillers, 12.9% soybean meal, 4.3% calcium carbonate, 4.3% calcium sulfate, 2.6% Omnigen AF (Phibro Animal Health Corp.), 1.1 Monocalcium phosphate, and <1% of each of the following: Sel-plex 600 (Alltech Biotechnology, Nicholasville, KY) and vitamin E.

2Mix contained 33.6% citrus pulp, 19% soybean meal, 15.6% canola meal, 14% soybean hulls, 4.5% calcium carbonate, 4.5% sodium bicarbonate, 2.8% urea, 2.7% fat, 2.4% sodium chloride, and <1% from each of the following: Monocalcium phosphate, biotin, and Rumensin 90 (Elanco Animal Health, Greenfield, IN).

3Mix contained 43.6% Fermenten (Church and Dwight Co., Princeton, NJ), 21.8% calcium carbonate, 10.8% soybean hulls, 7.8% Mintrex blend (Novus International Inc., St. Charles, MO), 5.2% blood meal, 3.5% magnesium oxide, 2.6% Celmanax (Vi-COR, Mason City, IA), 2.6% Omnigen (Phibro Animal Health Corp.), and <1% of each of the following: vitamin E, selenium selenite, and selenium yeast 600.

[4](http://www.journalofdairyscience.org/article/S0022-0302%2815%2900619-0/fulltext#back-tblfn0020)Mix contained 74.5% ground oats, 15.3% commercial amino acid, 8% Reashure (Balchem Encapsulates, Slate Hill, NY), and <1% of each of the following: vitamin E and Niashure (Balchem Corporation, New Hampton, NY).

[5](http://www.journalofdairyscience.org/article/S0022-0302%2815%2900619-0/fulltext#back-tblfn0025)Rumensin for dairy included at 4 890 mg/kg.

6Net energy for lactation.

**Supplementary Table S2.** *Comparison of tolerance testing glucose parameters and surrogate indices of insulin sensitivity in peripartal dairy cows.*1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | RQUICKI2 | HOMA-IR3 | QUICKI4 | RQUICKIBHB5 |
| Item | ρ6 | *P*-value | ρ | *P*-value | ρ | *P*-value | ρ | *P*-value |
| **Insulin tolerance7** |  |  |  |  |  |  |  |  |
| Glucose CR 0-10 min (%/min)8 | 0.35 | 0.05 | -0.22 | 0.20 | 0.21 | 0.22 | 0.28 | 0.10 |
| Glucose CR 0-20 min (%/min) | 0.27 | 0.13 | 0.03 | 0.88 | -0.03 | 0.85 | 0.17 | 0.35 |
| Glucose CR 0-30 min (%/min) | 0.31 | 0.08 | -0.05 | 0.79 | 0.03 | 0.87 | 0.21 | 0.23 |
| Glucose CR 0-40 min (%/min) | 0.07 | 0.72 | 0.13 | 0.44 | -0.13 | 0.44 | 0.07 | 0.71 |
| ISRG9  | 0.04 | 0.85 | 0.06 | 0.75 | -0.06 | 0.72 | -0.03 | 0.87 |
| Glucose AUC (mg 0-40 min/dL)10 | -0.11 | 0.54 | 0.04 | 0.83 | -0.04 | 0.81 | -0.06 | 0.75 |
|  |  |  |  |  |  |  |  |  |
| **Glucose tolerance11** |  |  |  |  |  |  |  |  |
| Glucose CR 0-30 min (%/min) | 0.19 | 0.29 | 0.06 | 0.74 | -0.08 | 0.64 | 0.42 | 0.01 |
| Glucose CR 0-60 min (%/min) | 0.25 | 0.17 | -0.02 | 0.92 | 0.00 | 0.98 | 0.39 | 0.02 |
| T1/2 (min)12 | -0.25 | 0.17 | 0.01 | 0.94 | 0.00 | 1.00 | -0.38 | 0.02 |
| Tbasal (min)13 | 0.10 | 0.58 | -0.05 | 0.77 | 0.05 | 0.77 | 0.02 | 0.89 |
| Glucose AUC (mg 0-180 min/dL) | 0.04 | 0.81 | 0.27 | 0.11 | -0.26 | 0.13 | -0.09 | 0.61 |
| FA14 CR 0-10 min (%/min) | 0.15 | 0.40 | -0.29 | 0.08 | 0.29 | 0.08 | 0.18 | 0.32 |
| FA CR 0-20 min (%/min) | 0.29 | 0.10 | -0.21 | 0.22 | 0.22 | 0.20 | 0.30 | 0.09 |
| FA CR 0-30 min (%/min) | 0.01 | 0.99 | -0.08 | 0.66 | 0.08 | 0.65 | 0.07 | 0.67 |
| FA CR 0-40 min (%/min) | 0.04 | 0.84 | -0.03 | 0.85 | 0.05 | 0.78 | 0.05 | 0.77 |
| FA AUC (mg 0-20 min/dL) | -0.08 | 0.67 | -0.37 | 0.03 | 0.39 | 0.02 | -0.32 | 0.07 |
| FA AUC (mg 0-30 min/dL) | -0.08 | 0.67 | -0.35 | 0.04 | 0.37 | 0.03 | -0.33 | 0.05 |
| FA AUC (mg 0-40 min/dL) | -0.07 | 0.69 | -0.34 | 0.04 | 0.36 | 0.03 | -0.34 | 0.05 |

1Description of abbreviation can be found within table 1.

2RQUICKI = revised quantitative insulin sensitivity check index.

3HOMA-IR = homeostasis model of insulin resistance.

4QUICKI = quantitative insulin sensitivity check.

5RQUICKIBHB = RQUICKI including BHB, BHB = β-hydroxybutyrate.

6Non-parametric Spearman’s rank-order correlation

7Data reflect samples collected at d 26 and 13 prepartum, and d 5 postpartum.

8CR = clearance rate.

9ISRG = insulin-stimulated reductions in glucose.

10AUC = area under the curve.

11Data reflect samples collected at d 25 and 12 prepartum, and d 6 postpartum.

12T1/2 = time to reach half maximal glucose concentration.

13Tbasal = time to reach basal glucose concentration.

14FA = fatty acids.



Supplemental Figure S1. Effect of prepartum body condition score (BCS) on milk production of dairy cows. Milk production data collected from postpartum lean and overweight dairy cows transitioning from gestation to lactation. (**A**) The continuous evaluation of milk yield. Early lactation milk (**B**) fat yield (kg/d), (**C**) fat %, (**D**) protein (kg/d), (**E**) protein %, (**F**) lactose (kg/d), and (**G**) lactose %, in cows assigned as lean or overweight -28 d prior to expected parturition. Data are represented as least squares means and their standard errors.



Supplemental Figure S2. Effect of prepartum body condition score (BCS) on percent glucose and fatty acids (FA) removal from baseline during an intravenous insulin tolerance test (ITT) and intravenous glucose tolerance test (GTT) performed in peripartal cows. Insulin tolerance testing was completed at (**A**) 26 and (**B**) 13 d prepartum, and (**C**) 5 d postpartum. Glucose tolerance testing was completed at (**D**) 25 and (**E**) 12 d prepartum, and (**F**) 6 d postpartum. Baseline measurements represent the average of samples collected at -10 and 0 min relative to intravenous administration of 0.01 IU of insulin per kg of BW, and intravenous administration of 300 mg of dextrose per kg of BW. Fixed effects in model for ITT: BCS (not significant), and Day < 0.05. Fixed effects in model for GTT: BCS (not significant), Day < 0.1, BCS × Minute < 0.1, and Day × Minute < 0.001. Data are represented as least squares means and their standard errors.