Concurrent Session 15: Metabolism

Fitness impacts on intermediary metabolism in horses

RL McMaster, AJ Tuszewski, DA Pace, FR Dunshea, PL Cakebread, BJ Leury
Melbourne School of Land and Environment, The University of Melbourne, Parkville 3010

Background – Adaptation to training in horses may impact upon the interplay between the endocrine system and intermediary metabolism. Better knowledge of insulin and intermediary metabolism in fit and unfit horses may help to improve our understanding of the relationship between variation in insulin sensitivity and performance and training adaptations, and health.
Objective – To investigate the effect of fitness on metabolic responses to dextrose and insulin tolerance tests during rest and to a dextrose tolerance test during exercise in horses.
Design – A series of experiments were imposed on 12 Standardbred horses (6 fit and 6 unfit) aged between 2 and 6 years old. Fitness was based on previous level of training and length of time horses had been spelled. Horses were given a dextrose (0.3 mg/kg) challenge during exercise and dextrose and insulin (0.132 U/kg) challenges at rest.
Outcomes – The peak plasma glucose response to dextrose was lower ($P<0.05$) while the rate of glucose clearance was greater ($P<0.05$) during exercise. Also, fit horses had a faster rate of glucose clearance ($P<0.05$) than unfit horses after a dextrose challenge, particularly during moderate exercise. Dextrose challenge caused an initial decrease followed by a rebound in plasma NEFA with the magnitude of the rebound being greater ($P<0.05$) in fit horses. Level of fitness had no influence ($P>0.20$) on the plasma glucose response to insulin.
Conclusion – These data demonstrate that the level of fitness impacts on glucose and fatty acid metabolism at both rest and during exercise in horses. There is potential for such measures to be used to assess the horse's relative fitness. As common metabolic diseases such as laminitis are linked to changes in insulin sensitivity, training may decrease the susceptibility of horses at risk.

Changes in plasma glucose, NEFA and insulin throughout extended lactation in dairy cows

LC Wild[1], KL Macmillan[2], C Grainger[3], CVC Phyn[4], BJ Leury[1]
Department of Agriculture and Food Systems, University of Melbourne, VIC 3010[1]
Department of Veterinary Science, University of Melbourne, VIC 3030[2]
Department of Primary Industries, Ellinbank, VIC 3281[3]
Dairy NZ Ltd, Hamilton 3240, NZ[4]

Background – Recent research has shown variation in the ability of dairy cows to extend lactation beyond the traditional 300 days. Some cows are more efficient at partitioning nutrients to milk production rather than body gain in a pasture-based system. The biological basis for this variation is not known but it may be partly associated with variation in whole animal insulin sensitivity.
Objective – To investigate changes in plasma glucose, NEFA and insulin throughout a 670-d lactation in cows.
Design – Holstein-Friesian cows were calved in July/August 2006 and managed for a 670-d lactation with an inter-calving period of 24 months. Blood was taken by coccygeal venipuncture from 40 cows (32 multiparous, 8 primiparous) at approx. 30, 150, 300, 450 and 600 days in milk (DIM) at 0800 h. All cows received a minimum energy intake of 180 MJ/cow/d. Following 300 DIM, cows were split into two groups of 20 which received either 180 or 160 MJ/kg/d. Insulin sensitivity (IS) was calculated by several indices (QUICKI, Q; RQUICKI, RQ; HOMA, H) using plasma concentrations of glucose, insulin and NEFA.
Outcomes – Plasma glucose, NEFA and insulin were affected by stage of lactation ($P<0.01$). IS (RQ, Q, H) was lower ($P<0.001$) at 30, 300 and 600 DIM compared with 150 and 450 DIM, which coincided with reduced liveweight and increased plasma NEFA and insulin. Neither diet nor parity (multi- vs. primi-parous) affected IS at any stage of lactation. Plasma glucose ($P<0.01$) and insulin ($P<0.05$) and IS (Q, $P<0.05$; H, $P<0.05$; positively and negatively, respectively) at 30 DIM were correlated to daily milk yield (L) at 300 and 450 DIM.
Conclusion – Insulin sensitivity, calculated from changes in glucose, NEFA and insulin, is altered by stage of lactation. Plasma glucose and insulin and IS in early lactation may explain some of the variation in daily milk yield during an extended lactation.