FISH OIL SUPPLEMENTATION ATTENUATES ABNORMAL GLUCOSE CLEARANCE CAUSED BY HIGH DIETARY FAT INTAKE IN AGED THOROUGHBRED GELDINGS

J.D. Pagan[A], *B.M. Waldridge*[A], *J. Lange*[A], *C.G. Brown-Douglas*[B] *and P.J. Huntington*[B]

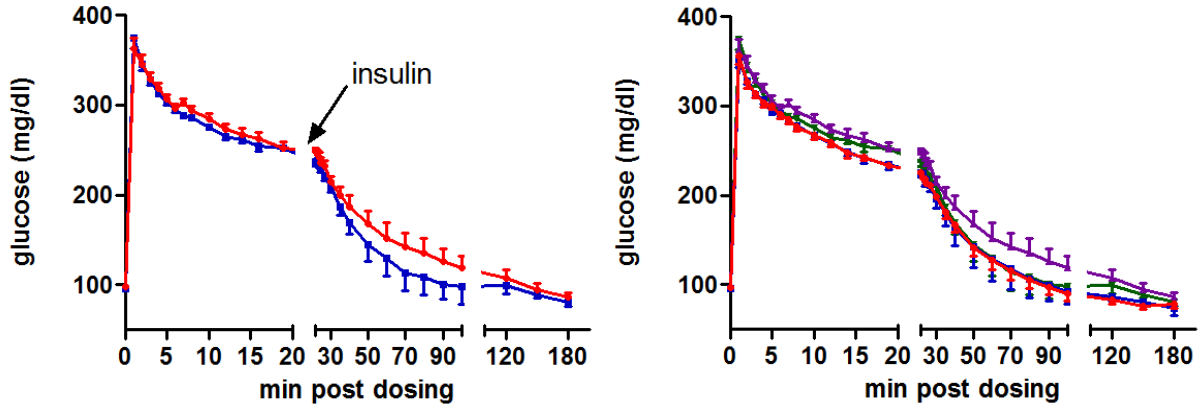
[A] Kentucky Equine Research, 3910 Delaney Ferry Rd, Versailles, KY 40383, USA
[B] Kentucky Equine Research Australasia, Mulgrave, VIC, 3170, Australia

Fats and oils are a good source of energy for horses, but there is a link in some species between high fat diets and insulin resistance (Frank, 2009). Long chain omega 3 fatty acid supplementation (DHA and EPA) prevented the development of insulin resistance and improved insulin sensitivity in some species (Kalupahana et al, 2010) and previous work in horses, indicated fish oil (as a source of DHA and EPA) supplementation moderated glucose response to a grain meal, but did not affect insulin sensitivity (Hoffman et al, 2011). The aim of this study was to investigate the glucose dynamics in horses fed a high fat or moderate carbohydrate diet and to investigate if fish oil moderated these effects.

Four aged, non-obese Thoroughbred geldings (21.5 yrs ± 3.32 yrs; Weight 572.16 Kg ± 50.53 Kg; BCS 5.0-6.0) were used in a 4x4 Latin square design study. The treatments consisted of 1.5% BW grass hay and 120g/d vitamin/mineral supplement and either 1. Oats (4.46g/kg BW) + 60g corn oil (OAT+CO) 2. Oats (4.46g/kg BW) + 60g fish oil (KERx EO3) (OAT+FO) 3. Hay cubes (2.59 g/kg BW) + soya oil (0.86 g/kg BW) + 60g corn oil (FAT+CO) 4. Hay cubes (2.59 g/kg BW) + soya oil (0.86 g/kg BW) + 60g fish oil[1] (FAT+FO). At the end of each 4 week treatment period, a frequently sampled glucose insulin test (FSGIT) was performed with 300 mg/kg glucose solution (50% dextrose) administered IV and frequent blood samples drawn for 180 minutes. At 20 minutes post glucose infusion, 20 mU/kg insulin (Humulin R) was administered. Plasma samples were tested for triglycerides, insulin and glucose. Data for the two OAT treatments, the two FAT treatments, and the differences between these were analysed using ANOVA and results presented at the 5% significance level.

Horses fed a high fat diet (FAT+CO) had decreased glucose clearance following a FSGIT compared with horses fed a moderate carbohydrate diet (OAT+CO) ($p<0.05$). Fish oil significantly affected glucose clearance in the high fat diet ($p<0.05$) (Figure 1a), but had no effect on glucose clearance in the moderate carbohydrate diet. Glucose clearance in the FAT+FO diet was not significantly different to either the OAT+FO or OAT+CO diets (Figure 1b). Moderate carbohydrate equates to 2.0-2.5 kg/d of grain and a high fat diet equates to about 500g/d of oil per day (for a 500kg horse).

Figure 1a Plasma glucose concentrations (mean ± SD) after a FSGIT in horses fed a high fat diet supplemented with either 60g of corn oil (FAT+CO) (■) or 60g of fish oil (FAT+FO) (■). **Figure 1b** Plasma glucose concentrations (mean ± SD) after a FSGIT in horses fed FAT+FO (■), FAT+CO (■), OAT+CO (■), and OAT+FO (■).



Frank N (2009). Equine Metabolic Syndrome. *Journal of Equine Veterinary Science*. 29:259-267

Kalupahana NS, Claycombe K, Newman SJ, Stewart T, Siriwardhana, Mattan N, Lichtenstein AH and Moustaid-Moussa N (2010). Eicosapentarnoic Acid Prevents and Reverses Insulin Resistance in High-Fat Diet-Induced Obese Mice via Modulation of Adipose Tissue Inflammation. *Journal of Nutrition*. 140:1915-1922.

Hoffman RM, Kayser JP, Lampley RM and Haffner JC (2011). Dietary fish oil supplementation affects plasma fatty acids and glycemic response but not insulin sensitivity in horses. *Journal of Equine Veterinary Science*. 31:252-253

[1]EO3, Kentucky Equine Research, Versailles, Kentucky, USA