18 December, 2013

Fish oil and corn oil supplementation affect red blood cell and serum eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) concentrations in Thoroughbred horses

J.D. Pagan, T.L. Lawrence, and M.A. Lennox
Kentucky Equine Research, Versailles, KY 40383, USA

Introduction

Horses require both omega-3 and omega-6 fatty acids in their diets. The omega-3 family stems from alpha-linolenic acid (ALA), while the omega-6 family originates from linoleic acid (LA). Long-chain omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are intermediates in the formation of eicosanoids that have been shown to reduce inflammatory responses, support immune function, and enhance fertility (Curtis et a~ 2000; Hall et aI., 2004; Stelzleni et aI., 2006; Vineyard et al. 2006). This study was conducted to compare the effect of supplementation with oil high in EPA and DHA (fish oil) or low in EPA and DHA (com oil) on red blood cell (RBC) and serum EPA and DHA.

Materials and Methods

Twelve Thoroughbred geldings were supplemented for 127 d with 60 ml of either fish oil (EO·3)[a] or com oil. They also received a basal diet of 8 kg of timothy hay and an unfortified sweet feed, soybean meal, sodium chloride, and calcium carbonate to meet NRC requirements. The horses were exercised three times weekly on a mechanical walker and turned out into small paddocks daily for 4-6 hours with muzzles to prevent grazing and housed overnight in 12 x 12 box stalls. Blood samples were taken at d 0, 29,57,92, and 127 in EDTA collection tubes before the morning feeding, placed immediately on ice, and analyzed for EPA and DHA.

Results and Discussion

By d 29, horses receiving fish oil had an average increase in serum EPA and DHA of 3.7-fold ($P \leq 0.05$) and 17.9-fold ($P \leq 0.01$), respectively (Figure I and 2). In horses receiving com oil, serum EPA decreased 1.5-fold from baseline at d 57 ($P \leq 0.05$) and fourfold by d 92 ($P \leq 0.05$). By d 127, RBC DHA concentrations in the fish oil supplemented horses was over 1.9-fold greater ($P \leq 0.05$) than baseline (Figure 3), while there was no difference observed in RBC DHA from horses receiving com oil. In the fish oil supplemented group, RBC EPA increased 11.5-fold ($P \leq 0.05$) by d 127 (Figure 4). Com oil supplemented horses had lower than baseline RBC EPA at 57 d ($P \leq 0.05$), 92 d, and 127 d *($P < 0.01$).*

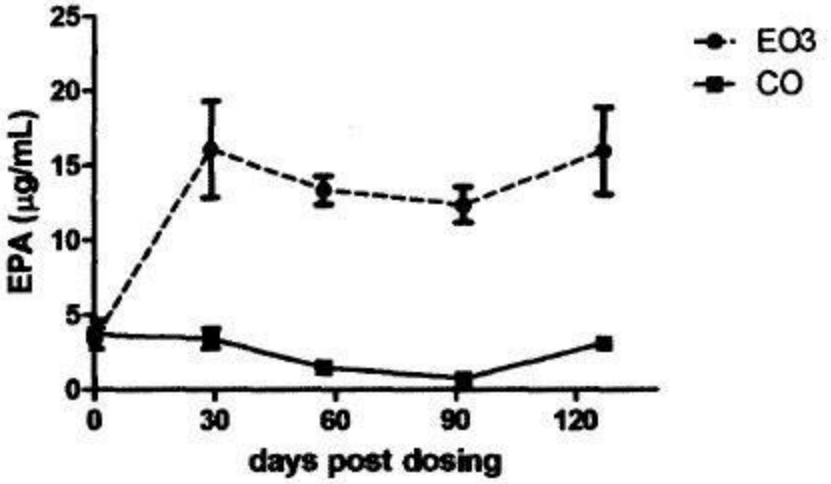

Figure 1. Serum EPA

Figure 2. Serum DHA

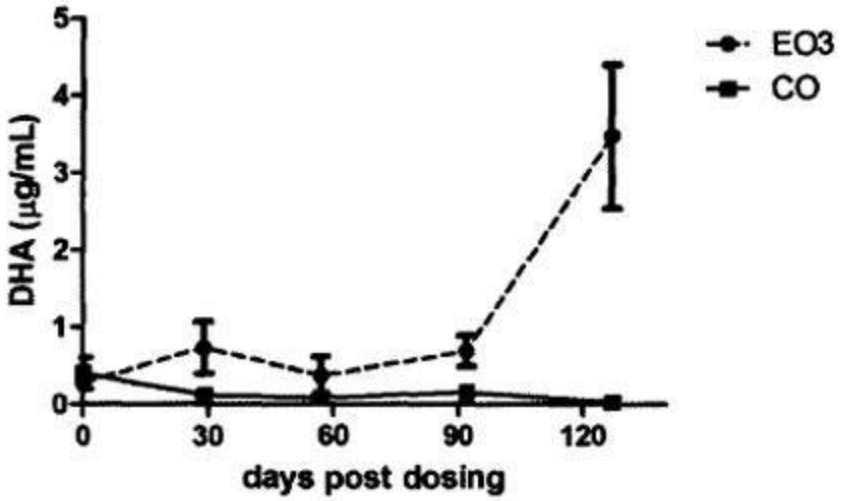

Figure 3.Red Blood Cell DHA

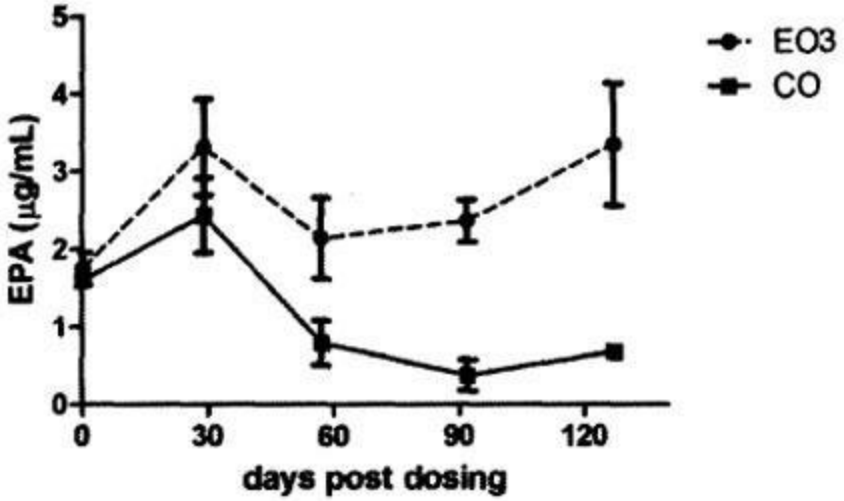

Figure 4. Red Blood Cell EPA

This study showed that 60 ml/d of fish oil supplementation increases serum and RBC EPA and DHA in horses. Com oil supplementation resulted in a decrease in RBC EPA, which may affect RBC membrane fragility.

References

Curtis, C.L., C.E. Hughes, C.R Flannery, C.B. Little, J.L. Harwood, B. Caterson. 2000. N-3 fatty acids specifically modulate metabolic factors involved in articular cartilage degradation. J. Biol. Chem 275,721-724.

Hall, J.A., R.J. Van Saun, S.J. Tornquist, J.L. Gradin, E.G. Pearson, RC. Wander. 2004. Effect of type of dietary polyunsaturated fatty acid supplement (com oil or fish oil) on immune responses in healthy horses. J. Vet. Intern. Med. 18,880-886.

Stelzleni, E.L., L.K Warren, J. Kivipelto. 2006. Effect of dietary n-3 fatty acid supplementation on plasma and milk composition and immune status of mares and foals. J. Anim Sci. SuppI. 84, 392.

Vineyard, KR, L.K Warren, KA. Skjolaas, lE. Minton, J. Kivipelto. 2006. Effects of dietary fish oil and flaxseed on plasma fatty acid composition and immune function in yearling horses. J. Anim. Sci. SuppI. 84, 393.

Footnote

[a]EO•3™,Kentucky Equine Research, Versailles, KY 40383 USA