

Changes in oxidative stress as a function of weight loss rate in obese ponies

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Introduction: In obese humans, oxidative stress is related to chronic disease (Vincent et al., 2007). Obesity increases oxidative stress as indicated by elevations in lipid peroxidation (Van Galle et al., 1998; Ozata et al., 2002) and lowered systemic antioxidants (Reitman et al., 2002). In obese children, altered oxidant-antioxidant status is reversible with a dietary restriction-weight loss program (Mohn et al., 2005; Kelishadi et al., 2008). Little is known, however, about the relationship between oxidative stress and obesity in horses.

Animals, material and methods: Eighteen obese healthy Shetland geldings (BCS 8+/- 1/9; Henneke et al., 1983; age 3-16 years) were studied over a 23.5 week period. During this trial, ponies received low energy hay (8.08 MJ/kg DM) and a commercially available protein, vitamin and mineral supplement (Spillers Gro'n Win®, MARS Horsecare). Average daily vitamin E supply via the supplement amounted 170 IU/100kg BW. The study started with a 4 week adaption period in which maintenance energy requirements to maintain stable obese body weight were individually determined (100% MERob). Then ponies were randomly divided into 3 groups: a control group (C), a 'slow' (S) and a 'rapid' (R) weight loss group which received respectively 100, 80 and 60% of their individual MERob for 16.5 weeks (weight loss period- WLP). The study finished with a 3 week period in which all groups were fed 100% of MERob in order to study any weight gain rebound effect (end phase). Oxidative stress (TBARS) and anti-oxidative capacity (FRAP, SOD and vitamin E) were measured. Statistical analysis is based on a linear model in which pairwise differences between treatments and time periods are significant when $P < 0.05$.

Results and discussion: During the WLP group C lost an average of $3.10 \pm 2.03\%$, group S $5.15 \pm 2.01\%$ and group R $12.56 \pm 2.06\%$ of their initial body weight. Weight loss was significantly higher in the R group compared to the S and C group. By the end of the trial, group C, S and R had respectively re-gained 1.11 ± 1.64 , 1.41 ± 1.04 and $3.40 \pm 0.94\%$ of their BW at the end of the WLP. Weight gain was significantly higher in the R compared to the C group. Between the beginning and the end of the WLP, a significant difference in the anti-oxidative stress markers FRAP and vit E was found between group C and R. Between the end of the WLP and the end of the trial, significant differences in the anti-oxidative stress markers were found between group C and R as well as S and R. In the same period, on the oxidative side (TBARS), there was a trend for a treatment effect between group C and R. No significant diet treatment effect was found for SOD.

Conclusion: Different levels of energy restriction and consequently weight loss appear to affect the oxidant/antioxidant balance, even though significant effects are only present with the highest energy restricted treatment. However, even these are not thought to be of biological significance.