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# Effects of two levels of a chromium supplement on selected metabolic responses in resting and exercising horses

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## Introduction

Chromium (Cr) amplifies the activity of insulin and Cr supplements given to diabetic humans stimulate the cellular uptake of glucose (*Mertz* 1993). The only reported study in which Cr was fed to exercising horses (5mg Cr/horse/day for 14 days) showed that the supplement reduced the levels of insulin, cortisol and glucose during an exercise bout (*Pagan* et al. 1995). The current study compared the effects of feeding either 4.15 or 8.3mg Cr/day.

## Materials and methods

Five trained Standardbred horses (mean BW 412±46kg) were housed individually in box stalls and given 3h free access to a sand paddock/d. Horses were fed a constant basal diet to meet energy and nutrient requirements according to GEH recommendations (1994). The concentrate was fed in 2 equal portions at 0700 and 1900h and the hay was fed in equal quantity at 0800, 1400 and 1930h with free access to water. At 0700h each horse was either fed Cr-free yeast or yeast to supply 10.1 or 20.2µg Cr/kgBW; 21d were allowed for adaptation to the dietary treatment prior to performing a standardized exercise test (SET).

Each horse completed an identical 3-month training programme on a high speed treadmill (Mustang 2200) inclined at 3%. This started with a warm-up (1.8m/s for 10min then 4m/s for 5min) and was followed by 45min at 5m/s; each day of exercise alternated with a rest day. SET's began 3h after the morning feed and comprised a warm-up (1.8m/s for 10min then 4m/s for 5min) and then 5 incremental steps each lasting 4min, starting at 5m/s and increasing by 1m/s to achieve 9m/s on the last step.

Plasma glucose and blood lactate were determined before a SET (at rest, 2h post-feeding), before the first step, after each subsequent step and after the SET (30, 120min and 24h). Serum insulin and cortisol was measured before a SET, after the last step and after the SET (30,120min and 24h).

Data were analysed by analysis of variance for repeated measurements and when 'F' values were significant, the Least Significant Difference Test was used. Multiple regression was used to examine if there was a relationship between serum hormones and plasma glucose.

## Results

Beyond 5m/s horses fed Cr supplements had higher blood lactate; increases were proportionate to quantity of Cr fed and, significant differences ($p<0.05$) were measured at 8 and 9m/s (see Figure 1). Plasma glucose fell after the warm-up but increased thereafter; values for Cr-supplemented hor-

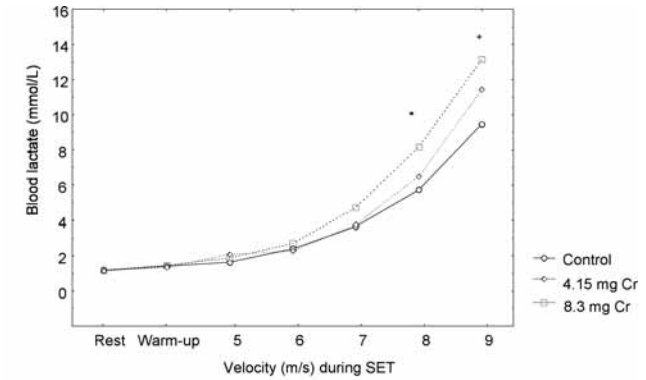


**Fig 1** Blood lactate concentrations (mmol/L) before, during, and after SETs for the different treatments (N=5, means, pooled SD: 3.8 mmol/L).

ses tended to be higher and at 8 and 9m/s, the highest values were for horses fed 8.3mg Cr/d (see Figure 2). There were no treatment-related differences in terms of serum insu-

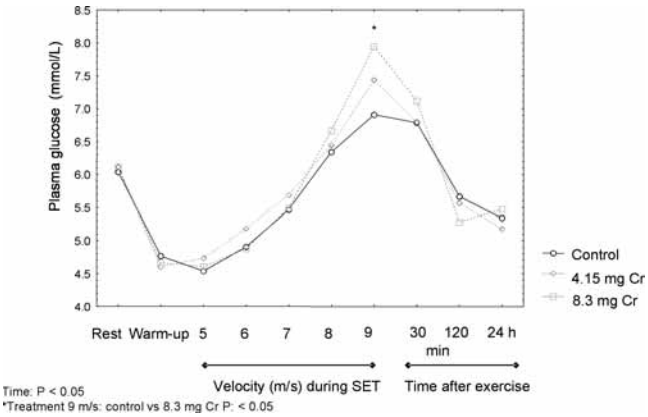


**Fig 2** Plasma glucose concentrations (mmol/L) before, during and after SETs, and during recovery period for the different treatments (N = 5, means, pooled SD: 0.95 mmol/L).

**Table 1** Serum insulin (μU/mL) and cortisol (ng/mL) concentrations before and after SETs, and during the recovery period for the different treatments (N=5, means±SD).

| Parameter | Treatment | Before[1] | After | 30 min | 120 min | 24 h |
|---|---|---|---|---|---|---|
| | | SET | | Post-exercise recovery period | | |
| Insulin | Control | 14.8± 2.9 $^{a}$ | 1.2 ± 0.2 $^{b}$ | 20.6 ± 7.7 $^{c*+}$ | 4.9 ±3.3 $^{d*+}$ | 2.3± 0.7 $^{d}$ |
| | 4.15 mg Cr | 15.2± 7.1 $^{a}$ | 1.2 ± 0.2 $^{b}$ | 14.7 ± 12.8 $^{c+}$ | 11.7 ±10.0 $^{d+}$ | 3.4± 2.4 $^{e}$ |
| | 8.3 mg Cr | 17.3±10.0 $^{a}$ | 1.1 ± 0.3 $^{b}$ | 21.7 ± 6.8 $^{c*}$ | 4.8 ±5.2 $^{d*}$ | 4.2± 1.5 $^{d}$ |
| Cortisol | Control | 45 ± 22 $^{a}$ | 89 ± 22 $^{b}$ | 110± 31 $^{c*}$ | 62 ± 13 $^{d}$ | 35± 19 $^{a}$ |
| | 4.15 mg Cr | 47 ± 21 $^{a}$ | 81 ± 21 $^{b}$ | 92 ±15 $^{c*+}$ | 62 ± 19 $^{d}$ | 35± 14 $^{a}$ |
| | 8.3 mg Cr | 37 ± 12 $^{a}$ | 83 ± 12 $^{b}$ | 99±22 $^{c+}$ | 61 ± 11 $^{d}$ | 30± 6 $^{a}$ |

[1]blood sampling at rest
Mean values in the same row with unlike lower-case superscripts are significantly different (P < 0.05), mean values in the same column with unlike symbols are significantly different (P < 0.05)

lin (Table 1) although there were significant ($p<0.05$) differences in relation to the SET. 30min after the SET, values rebounded and were similar to those before the SET before falling to low levels 24h after the SET. There was no clear relationship between plasma glucose and serum insulin whereas in contrast, there was a strong relationship ($r^2=0.61$) between serum cortisol and glucose. The former increased with exercise and until 30min after the SET before returning to pre-exercise levels 24h later; there were no significant treatment effects.

## Discussion

In the current study Cr supplements did not apparently affect glucose 'handling' in that plasma glucose and lactate together with serum insulin were largely unaffected although higher peak glucose and lactate values were measured in Cr-supplemented horses at 8 and 9m/s. This is in direct contrast to the results of *Pagan* et al., (1995) that showed that 5mg Cr/d lowered blood levels of insulin, cortisol and glucose during exercise in trained thoroughbreds. However, these findings are questionable since blood glucose fell below 4mmol/l during high-speed exercise and cortisol would be expected to increase. High heart rates and blood lactate measured at the end of exercise would suggest that exercise capacity of these Cr-supplemented horses would be compromised.

## Conclusion

Cr supplementation of healthy trained horses has no apparent beneficial effect and thus its use in these animals is contraindicated.

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