

RESEARCH REPORT

ABSTRACT

The Effects of Administration of Tetrachlorvinphos Fly Control (Equitrol®) on Physical Parameters, Blood Cholinesterase Levels, Blood Cytokine Profiles, Serum Thyroid Values, and Selected Behavioral Stimuli in Horses

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The objective of this study was to assess the effects of tetrachlorvinphos (TCVP) (Equitrol®) feeding on clinical physical parameters, blood cholinesterase levels, blood cytokine profiles, serum thyroid levels, and behavioral responses to stimuli in horses. Ten horses (six mares and four geldings) of various breeds (three Thoroughbred, three Standardbred, and four Quarter Horses) and ages (11 to 23 years old) were included in this study. The horses were housed individually in covered pipe pens at the Center for Equine Health at UC Davis. They were fed a mixture of alfalfa and oat hay and supplements daily.

Two treatment groups were used for the study. One group, T1 (n=6), was fed TCVP in addition to their feed and supplements, while the second group, T2 (n=4), received only feed and supplements. The horses were divided randomly into the two groups. Group T1 received the product TCVP once daily mixed in with the supplement. Animals were dosed according to their body weight. The following formula was used to calculate TCVP dosages for each of the T1 group animals:

$$\frac{\text{Body Weight (lb)}}{1000\text{lbs}} \times 28.38 \text{ g} = \text{g of TCVP dosage}$$

Doses for the individual animals were placed in a Ziplock bag identified by animal number for daily dosing in the feed. Sweet feed was measured daily into a measurement scoop. All animals were fed the same amount of sweet feed in individually labeled plastic buckets prior to hay feeding in the morning.

Prior to the start of the study, horses were allowed an adjustment period for 1 week. The TCVP was fed daily for 30 days to the T1 group. Sweet feed was continually fed until the end of the trial on day 60.

Horses were fed TCVP at the suggested daily dose for fly control for 30 days. Blood was collected from all 10 horses at the following time points: before the start of the study at -2, -1.5, -1, and -0.5 days. At time 0, TCVP was fed to the T1 horses for a total of 30 days. Blood was again collected from all horses (T1 and T2 groups) at the following time points: every 12 hours for the first 9 days and then once daily on days 10, 14, 18, 22, 26, and 30. TCVP was discontinued on day 30 and blood samples were collected on the following days: 33, 34, 35, 36, 37, 39, 41, 43, 46, 48, 50, 53, 55, and 57. Blood samples were collected at the same time of the day (either 8 AM or 8 PM). Samples were submitted to the CAHFS Toxicology Laboratory daily for determination of cholinesterase activity.

Physical Parameters

No statistical differences were observed for TCVP-fed horses (group T1) compared with non-TCVP-fed horses (T2) (data not shown).

Blood Cholinesterase Levels

Cholinesterase activities were determined on whole blood using a modification of the Ellman method (Richardson et al., 1992), in which the reaction measures cholinesterase-induced hydrolysis of acetylthiocholine to thiocholine. Thiocholine reacts with 5,5'-dithio-bis(2-nitrobenzoic acid) to produce a yellow color. The rate of color production is measured at 405 nm using a spectrophotometer. The activity of cholinesterase is expressed in micromoles of acetylthiocholine hydrolyzed per milliliter of blood per minute.

Horses fed TCVP had lower blood cholinesterase levels compared with the control horses on days 7, 14, 22, 30, 36, and 43 (see Figure 1). However, statistical analysis using a repeated measurement of variance is yet to be performed to determine whether and at what time point TCVP administration significantly affected blood cholinesterase activity.

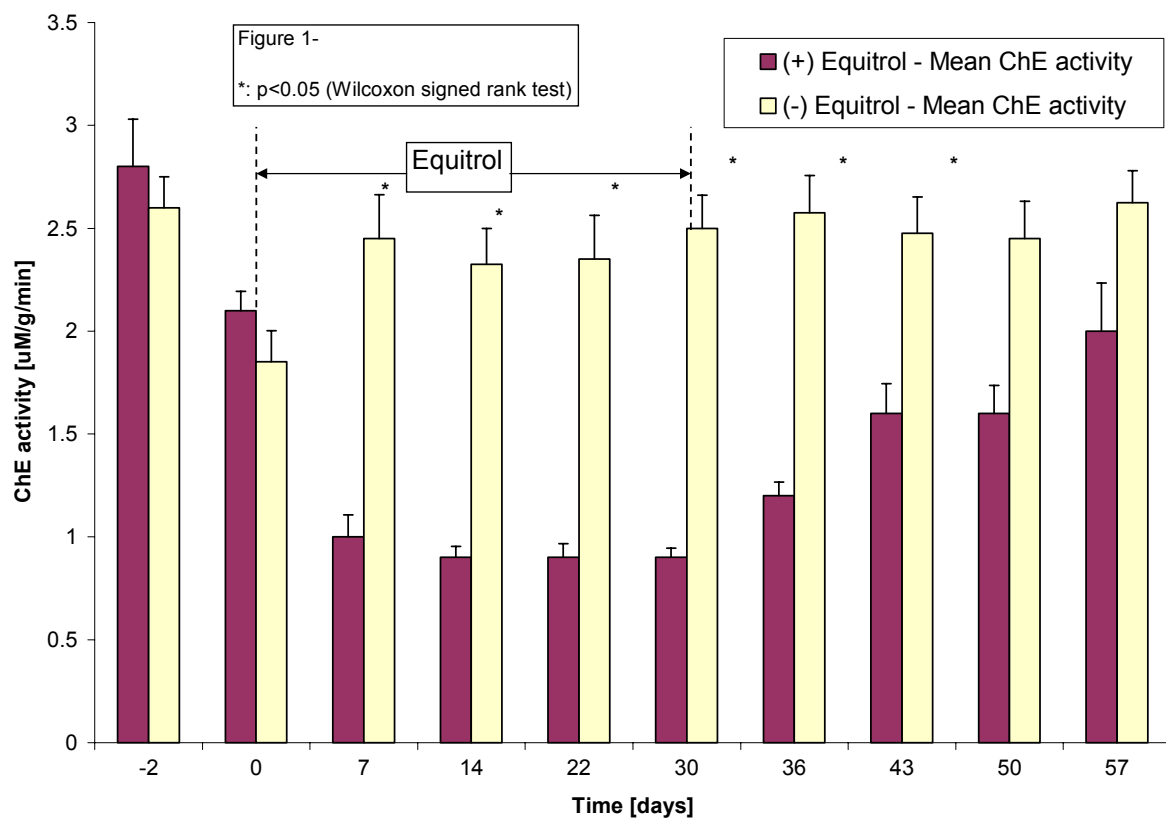


Figure 1. BLOOD CHOLINESTERASE LEVELS IN TCVP-FED HORSES VS. CONTROLS

Cytokine Profiles

No statistically significant differences were observed for TCVP-fed horses compared with the controls (data not shown).

Serum Thyroid Values

No statistically significant differences were observed for TCVP-fed horses compared with the controls (data not shown).

Selected Behavioral Responses to Stimuli

The objective of this aspect of the study was to assess four standardized behavioral responses to specific stimuli in horses while being fed TCVP and when not being fed TCVP as well as in control horses evaluated at the same time intervals to examine any potential effects on behavior.

The behavior testing was performed on day 14 (on TCVP) of the study and repeated on day 56 (day 26 post-TCVP feeding). Testing was performed on horses in a blind fashion by one observer for consistency (JBP). Four behavioral stimuli were conducted in response to a horseman's training flag 1) following the flag, 2) approach to right shoulder, 3) approach to left shoulder, 4) yielding the hind quarters to stimuli. Responses were scored using a scale of 1 through 4 scale, with 1 being accepting and 4 resistance and avoidance.

The results are depicted in Figure 2 for TCVP-fed horses. In the T1 group, sum scores for behavioral assessment revealed significantly higher scores in the horses while they were being fed TCVP compared with during the non-TCVP feeding period. No change occurred in behavioral assessment scoring in the control group. Asterisk indicates statistically significant result using Mann-Whitney test ($p < 0.05$).

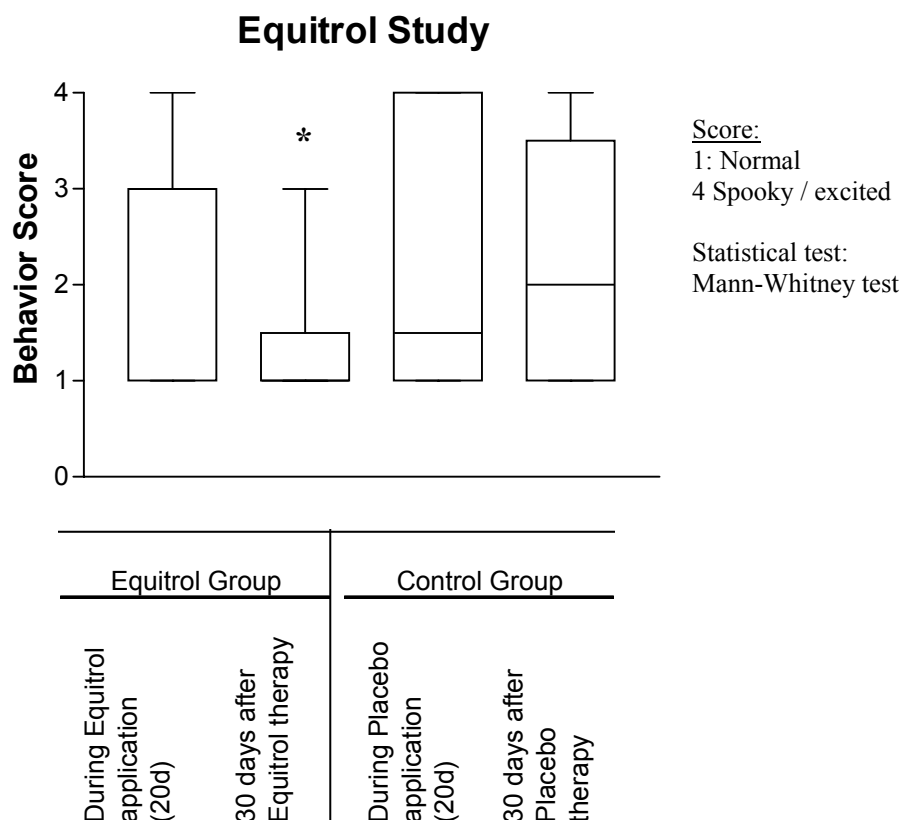


Figure 1. BEHAVIORAL ASSESSMENT IN HORSES RECEIVING TCVP (EQUITROL®)

Conclusions

Under the conditions of this study, whole blood cholinesterase levels decreased significantly in response to TCVP feeding, indicating absorption of TCVP in the fed product (Equitrol®). No changes occurred in cytokine or thyroid parameters during the 30-day clinical trial in TCVP-fed or control horses. Behavioral testing revealed evidence of a higher excitability scoring in response to the specific stimuli provided during periods of feeding TCVP versus the same horses when not being fed TCVP. Based on these results, additional studies are warranted to further characterize and evaluate the metabolic, immunologic, and behavioral effects of TCVP in horses.