The relationship between urine cannabinoid concentration and choice reaction time in chronic marijuana users

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INTRODUCTION:
The aim of this study was to investigate whether urine cannabinoid levels in a group of chronic marijuana users were associated with choice reaction times as measured by a computerized neurocognitive test able to measure reaction time with millisecond (mS) precision. Research on the cognitive effects of cannabis has yielded inconsistent results.(1,2)

METHODS:
At the baseline visit before treatment randomization in the parent marijuana cessation trial, 114 participants completed a comprehensive computerized neurocognitive testing battery (CNS Vital Signs)(3). A component of the battery is the Continuous Performance Test (CPT), a well-known test measuring choice reaction time. Participants are asked to perform a task, responding only when a pre-defined stimulus (target) appears across a field of foils. As the task is relatively simple, CPTs have a ceiling effect (perfect "correct vs incorrect" scores are common). Data for participants scoring a perfect "correct vs incorrect" score on the CPT were analyzed by comparing the reaction times to the urine cannabinoid levels. A urine creatinine-normalized cannabinoid test was used to reliably compare quantitative levels (urine cannabinoid level/urine creatinine level). Regression analysis of the CPT reaction time compared to urine creatinine-normalized cannabinoid level was performed.

RESULTS:
Of the cross-section of 114 participants tested at baseline, 18 achieved a perfect score on the CPT. The mean reaction time for the sample was 381 mS while the median reaction time was 384 mS. The range was 303 mS to 457 mS. Further analysis of that group revealed a significant linear relationship between reaction time and urine creatinine-normalized cannabinoid level (p=.0091), with a correlation coefficient of 0.596 (95% CI 0.1784-0.836).

CONCLUSIONS:
Participants with higher urine cannabinoid concentrations had slower reaction times. This finding suggests tests that precisely measured reaction times may identify subtle levels of marijuana-related impairment not observable using routine methods.

REFERENCES
[1]Grant I, Gonzalez R, Carey CL, et al. Non-acute (residual) neurocognitive effects of cannabis use: a meta-analytic study. J Int Neuropsychol Soc. 2003 Jul; 9(5): 679-89.
[2]Kelleher LM, Stough C, Sergejew AA, Rolfe T. The effects of cannabis on information-processing speed. Addict Behav. 2004 Aug;29(6):1213-9.
[3] Gualtieri CG, Johnson LG. Reliability and validity of a computerized neurocognitive test battery, CNS Vital Signs. Arch Clin Neuropsychol. 2006 Oct; 21(7): 623-43.
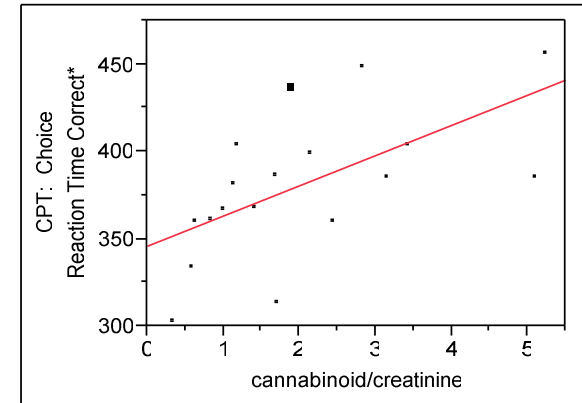
p=0.0091-Choice Reaction Time Correct* = 346.01725 + 17.31417*cannabinoid/creatinine
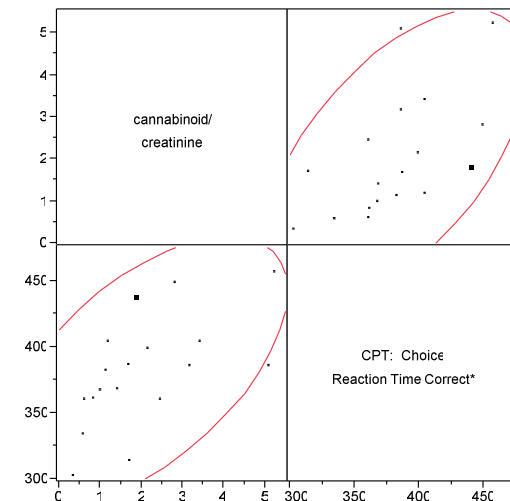
	Canabinoid/Creatinine	CPT Choice Reaction Time Correct
Cannabinoid/Creatinine	1	0.5956
CPT Choice Reaction Time Correct	0.5956	1

CI of Correlation: 95% Confidence Interval (0.1784-0.8367)