**Title**: Detecting changes in pupil response to light associated with cannabis consumption

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**Abstract:**

Introduction: Given the roadside safety and occupational injury prevention implications of recent cannabis use, there is a need for objective and validated measures of recent cannabis use that may be applied to enforce regulations and reduce the risk of injury. Pupillary response to light may offer an avenue for detection that outperforms typical sobriety tests and blood THC concentrations.

Method: 84 participants (mean age: 32, 42% female) with daily, occasional, and no-use cannabis use histories participated in tests of pupillary light response after smoking cannabis *ad libitum* (daily/occasional) or relaxing for 15 minutes (no use). The impact of recent cannabis consumption on trajectories of the pupillary light response was modeled using tools from functional data analysis. Logistic regression models for predicting recent cannabis use were compared, and average pupil trajectories across cannabis use groups and times since light test administration were estimated.

Results: Models revealed small but significant differences in pupil response to light after cannabis use comparing the occasional use group to the no use control group, and similar statistically significant differences in pupil response patterns comparing the daily use group to the no use controls. Additionally, a model predicting recent cannabis use using functional data analysis methods outperformed a predictive model using traditional methods (AUC: 0.71 vs 0.68, p= 0.6). Estimated trajectories of pupillary light response found that acute cannabis smoking was associated with less initial and sustained constriction compared to controls.

Conclusion: These analyses show the promise of pairing pupillary light response and functional data analysis methods to assess recent cannabis use.

Practical Applications: Pupillary light response tests, when paired with functional data methods, and future refinements in precision pupillometry, may offer an objective measure of recent cannabis consumption. With further refinement, this measure may help to address public health concerns around recent cannabis use, roadside safety and occupational injury prevention.

**Keywords**: pupillary light reflex, pupillometry, cannabis, functional data analysis, substance abuse detection