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Continuous monitoring of individual rats when group housed in the home cage to assess drug induced changes in activity and temperature

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Introduction:Conventional approaches for measuring the activity of rats necessitate single housing, which affects their behaviour and welfare. We have used a subcutaneous RFID transponder to measure ambulatory activity and temperature of individual rats when group-housed in conventional, rack-mounted home cages. The transponder location and temperature is detected by a matrix of antennae in a baseplate under the cage. Baseplate-derived ambulatory activity correlates well with manual tracking, and we have also demonstrated the system can detect the sedative and hypothermic effects of chlorpromazine (Tse et al., 2016). The objective of the current study was to evaluate whether the system can detect effects of (+)-amphetamine.

Method:(+)-Amphetamine (10mg/kg oral) or its vehicle (sterile water; 10mL/kg oral) was dosed to male Han Wistar rats (200-275g, n=6/group; housed in 3s), on separate occasions during the light and dark phases with 24h continuous monitoring using the Home Cage Analyser (ActualHCA™, Actual Analytics, UK).

Results:An increase in AUC of the 12h activity ($P<0.01$) and temperature profiles ($P<0.01$) was detected in response to (+)-amphetamine. When dosed in the light phase, maximum activity was increased from 44±13 to 194±29 transitions during 0.5-12h post-dose ($P<0.05$), with maximum temperature increased from 36.2±0.2 to 37.7±0.3^{o}C during 1-3.5h post-dose ($P<0.05$). When a cage change was introduced 2h post-dose (to stimulate a conventional 'novel arena' locomotor activity test), (+)-amphetamine caused maximum activity increase from 5.4±2.4 to 155±34 transitions during 0.5-11.5h post-dose, with maximum temperature increased from 35.6±0.4 to 37.5±0.3^{o}C during 1-6.5h post-dose ($P<0.05$). When dosed in the dark phase, maximum activity increased from 31.4±3.3 to 185±40 transitions during 0.5-8h post-dose ($P<0.05$), with maximum temperature increased from 36.1±0.2 to 37.8±0.4^{o}C during 1-3h post-dose ($P<0.05$). The system was able to detect stimulant and hyperthermic effects of amphetamine in a continuous profile with minimal disturbance, with subtle differences when dosing during the light or dark phase.

Conclusion:Together with our previous data on chlorpromazine, we have demonstrated that this home cage monitoring system can reliably detect increases and decreases in activity and temperature in rats. The benefits of this technology include being able to greatly increase the information content and dimension of existing protocols by incorporating measurement of activity and temperature of individual rats when group-housed in their home cage.

References:Tse K et al. (2016) *Safety Pharmacology Society 16th Annual Meeting, Vancouver, BC, Canada (Proceedings).*