LOCAL CEREBRAL GLUCOSE UTILIZATION RATES IN HIGH ALCOHOL-DRINKING HAD AND LOW ALCOHOL-DRINKING LAD RATS

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Background: The present studies compare local cerebral glucose utilization (LCGU) rates within reward-relevant brain regions in adult, male high alcohol-drinking (HAD) and low alcohol-drinking (LAD) rats from replicate lines 1 and 2. Experiment #1 measured baseline LCGU, while Experiment #2 measured LCGU following acute ethanol exposure. **Methods:** 2-[^{14}C]Deoxyglucose ([^{14}C]2-DG) was injected (125 μCi/kg, *i.v.*) during the rats' dark cycle. Timed arterial blood samples were collected over 45 min and assayed for glucose and [^{14}C]2-DG content. Rats were then decapitated; their brains quickly removed and frozen in isopentane at –50°C. Coronal brain sections were apposed to film for 2 days. Image densities were analyzed using quantitative autoradiography. LCGU rates were calculated using the operational equation of Sokoloff *et al.* (1977). LCGU rates were compared by ANOVA, with repeated measures and *post-hoc* comparisons where appropriate. For Experiment #2, rats were also injected *i.p* with saline, 0.25g/kg ethanol or 1.0g/kg ethanol, 10 minutes prior to [^{14}C]2-DG injection, and arterial samples were assayed for blood ethanol content. **Results:** Data were collected from limbic (nucleus accumbens, VTA, olfactory tubercle, amygdala, hippocampus, ventral pallidum and septum), basal ganglia, cortical (medial prefrontal, frontal, parietal, temporal, occipital, entorhinal, pyriform and cingulate) and subcortical (thalamus, habenula, superior colliculus) structures. Experiment #1 revealed a trend for higher baseline LCGU in HAD versus LAD rats in several cortical regions as well as in the habenula, but none of these line differences reached statistical significance. Experiment #2 revealed a significantly decreased LCGU within cingulate cortex, layer 4 of temporal cortex and the medial geniculate nucleus of the thalamus following 1.0g/kg ethanol, but no significant LCGU differences were observed between HAD and LAD rats.

Conclusions: These findings suggest that, within HAD and LAD rats, the selection for alcohol preference did not lead to significant intrinsic differences in functional brain activity as measured with the 2-DG method. Acute *i.p.* ethanol in these animals had limited effects on LCGU, but these effects did not differ between the lines for the doses employed. A wider ethanol dose range might elicit greater changes in metabolic activation as well as divergent LCGU responses in HAD and LAD rats.

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