DIFFERENTIAL EFFECTS OF ACUTE ETHANOL ON THE DOPAMINERGIC AND SEROTONERGIC SYSTEMS IN RAT BRAIN

by

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ABSTRACT

DIFFERENTIAL EFFECTS OF ACUTE ETHANOL ON THE DOPAMINERGIC AND SEROTONERGIC SYSTEMS IN RAT BRAIN.

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Low doses of ethanol have a stimulatory effect while higher doses have a depressant action on behavior in both humans and experimental animals. However, to date, there are no known neurochemical correlates of these two responses to ethanol. Therefore, the objectives of this research project were to determine if low and high doses of acute ethanol have differential actions on specific dopamine (DA) and serotonin (5-HT) neuronal systems in the CNS.

Adult, male Wistar rats were injected IP with either saline, 0.5 or 2.5 g ethanol/kg body wt. and killed 15, 30 or 60 minutes later. The brain was dissected into the following areas : nucleus accumbens (ACC), lateral septal nucleus (LSN), olfactory tubercles (OT), frontal cortex (FCTX), posterior striatum (STR), olfactory bulbs (OB), hypothalamus (HY), thalamus (TH) and tegmentum (TEG). Each region was assayed by HPLC-EC for its contents of DA, 3,4-dihydroxyphenylacetic acid (DOPAC), 4-hydroxy-3-

methoxyphenylacetic acid (homovanillic acid, HVA), 5-HT and 5-hydroxyindoleacetic acid (5-HIAA).

Only the high (2.5 g/kg) dose of ethanol (and usually only after 60 minutes) caused statistically significant increases above control values in DOPAC and/or HVA levels in the following areas : ACC, 150-180%; LSN, 160-200%; OT, 140%; FCTX, 140%; STR, 170%; HY, 150-160% and TEG, 130%. Similarly, the levels of 5-HIAA were significantly elevated above control values in the ACC (126%) and STR (121%). On the other hand, the levels of DA and 5-HT were not altered by either dose of ethanol at any of the time points examined.

The elevated contents of DOPAC and/or HVA observed 60 minutes after the high dose of ethanol suggest selective activation of DA neurons projecting from the (a) substantia nigra to the STR; (b) ventral tegmental area (and possibly retrorubral nucleus) to the OT, LSN, ACC and FCTX; and (c) incertohypothalamic system in the HY. As for the 5-HT system, the high dose of ethanol resulted in a selective activation of 5-HT neurons in the nucleus raphe dorsalis that project to the ACC and STR via the dorsal ascending pathway.

Therefore, the results obtained from this study indicate that ethanol acts at specific sites in the CNS.

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