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Impact of gasoline inhalation on free excitatory and inhibitory amino acids of hippocampus, cerebellum and hypothalamus in the male rats

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Abstract

This study was designed to investigate the impact of exposure to the vapours of two kinds of gasoline (a petroleum-derived liquid mixture consisting primarily of hydrocarbons and octane enhancers, used as fuel in internal combustion engines) on the levels of the excitatory and inhibitory amino acid neurotransmitters of the rat brain. The first kind contains octane enhancers in the form of lead derivatives (leaded gasoline; G1) and the other contains methyl-tertiary butyl ether (MTBE) as the octane enhancer (unleaded gasoline; G2). The levels of the major excitatory (aspartic acid and glutamic acid) and the inhibitory (GABA and glycine) amino acid neurotransmitters were determined in the cerebral cortex, hippocampus, cerebellum and hypothalamus. The exposure to the gasoline vapours alters the levels of these neurotransmitters resulting in perturbations of brain's cognitive and sensorimotor functions. The current study revealed that the acute inhalation of the two types of gasoline (for 30 minutes) induced elevation in the levels of aspartic and glutamic acids along with a decrease in glycine and GABA in most studied brain areas. Chronic inhalation of both types gasoline (for 60 days) caused significant increases in the aspartic and glutamic acids of the hippocampus without affecting the levels of GABA and glycine. In the hypothalamus, aspartic acid and glutamic acid levels were higher in rats exposed to either one of the two gasoline types than those of the control group. The effect of G2 was more prominent than that of G1. In the cerebral cortex, G1 vapours caused a significant decrease in the aspartic acid and glutamic acid levels concomitant with an increase in GABA level. On the contrary, aspartic acid and glutamic acid levels were higher in the G2 than those in either the control or G1 groups. The short-term exposure to both type of gasoline (for 7 days) had no effect on the amino acid neurotransmitters under study. Acute and chronic inhalation of either one of G1 and G2 vapours induced disturbances and fluctuation in the levels of the free amino acids that act as excitatory and inhibitory neurotransmitters in the brain areas under investigation. These neurotransmitters are fundamental for the communicative functioning of the brain and such effects may have a profound impact on the cognitive and sensorimotor functions of the brain resulting in serious psychological and physiological disorders.