INTRODUCTION
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Neuroscience research is essential for understanding the biological basis of ethanol-related brain alterations and for identifying the molecular targets for therapeutic compounds that can alter ethanol's actions in the brain and body. Many different biological systems in the brain are influenced by ethanol and result in brain adaptations that form the underpinnings of ethanol addiction. Brain is the major target for the actions of ethanol and it can affect the brain and behaviour in a variety of ways, multiple factors can influence these effects. The neurotoxicity of ethanol determines, modulates or modifies the brain functions during the course of ethanol treatment. Ethanol stimulates the release of β-endorphins, responsible for euphoria and anesthesia, accounting for some of the intoxicating effects of ethanol. Ethanol can cause physical addiction directly through its effects on many receptor sites in the postsynaptic membranes of neurons. Changes in the brain include depletion and interference in neurons and chemical messengers involved in signalling that result in a dependence on ethanol. Brain neurotransmitters through their receptors or hormonal pathway play an important role in governing the cellular activities.

Consumption of ethanol interferes differentially with transmission processes in the central nervous system (CNS), affecting many of the neurotransmitter systems. Ethanol acts at many sites - including the reticular formation, spinal cord, cerebellum, cerebral cortex and on many neurotransmitter systems. The effects of ethanol on the brain result mainly from its action on the postsynaptic receptor sites for various neurotransmitters. Brain serotonin and
dopamine along with other neurotransmitters play an important role in the brain process underlying ethanol addiction. Development of addiction appears to be with abnormal neurotransmitter systems.

Serotonin (5-HT) and dopamine (DA) are the two major neurotransmitters involved in ethanol addiction. Ethanol alters neuronal cell membranes as well as their ion channels, enzymes and receptors. Ethanol also binds directly to the receptors causing the prolonged stimulating or inhibiting impulse, depending on which area of the brain it is present. Ethanol not only affects the neurotransmitters individually, but also influences the interactions of these neurotransmitters, opening of the chloride ion channels and the greater uptake of chloride ions by the post-synaptic cell. Ethanol addiction leads to morphological and functional degeneration of rat peripheral sympathetic nervous system. 5-HT does not act alone within the brain. Instead, serotonergic neurons are parts of larger circuits of interconnected neurons that transmit information within and among brain regions. Many neurons within these circuits release neurotransmitters other than serotonin. The exact effect of ethanol on these neurotransmitters is still under study. Some of the 5-HT mediated neuronal responses to ethanol may arise from interactions between serotonin and other neurotransmitters. Serotonin can alter dopaminergic neuronal activity through 5-HT₂ receptors by its interaction with the dopaminergic system. Systemic administration of ethanol increases the firing rate of mesolimbic dopamine neurons. Ethanol appears to facilitate dopamine release by increasing opioidergic activity and dopaminergic neurons by inhibition of GABAergic neurotransmission via opioid receptors in the ventral tegmental area (VTA).
Mesolimbic dopamine release induced by ethanol consumption indicates that ethanol-related stimuli are important.

Both short and long-term ethanol exposure also affect the serotonin receptors that convert the chemical signal produced by serotonin into functional changes in the signal-receiving cell. Neuronal dopamine receptors are widely distributed in the central and the peripheral nervous system at different levels. Serotonin seems to be involved in ethanol's acute reinforcing effects. The exact mechanisms that may be involved still need to be clarified. Depending on the dose, ethanol stimulates locomotor activity and produces an increase in dopamine levels in the nucleus accumbens. Brain peptide corticotropin releasing factor (CRF) with ethanol appears to influence neurotransmission in the amygdala, by increasing the transmission of gamma amino butyric acid (GABA). Ethanol not only affects the neurotransmitters individually, but also influences the interactions of these neurotransmitters when working together as 5-HT may interact with neurons that secrete GABA. If ethanol is present, the ethanol influenced 5-HT may affect the actions of GABA neurons in areas involving behavioural output such as the hippocampal formation, where cognitive decisions are made. Similarly, ethanol influenced 5-HT stimulates dopamine production and thus more extreme behavioural outputs.

Postsynaptic receptor sites for various neurotransmitters are affected by the acute effects of ethanol. They exert their function through receptors present in both neuronal and non-neuronal cell surface that trigger second messenger signalling pathways. Chronic ethanol consumption has been associated with an increased dopamine turnover rate and decreased dopamine uptake. Genetic
variability in the 5-HT$_{2A}$ receptor is involved in the development of ethanol dependence. Another series of studies suggest that ethanol-induced reward is independent of the activation of DA D$_2$ receptors mediated through 5-HT$_{1B}$ and 5-HT$_2$ receptors. Ethanol increases the amount of dopamine acting on receptors and enhances the normal feeling of pleasure associated with the dopaminergic system. Chronic ethanol treatment may decrease serotonergic neurotransmission in selective brain regions. Ethanol has several actions on the central nervous system believed to be mediated by non-specific physicochemical effects on the membrane or by actions through specific receptors. Ethanol has a variety of effects on neuroendocrine function and there is a great deal of interest in investigating the effects of ethanol on the hypothalamic–pituitary–adrenal (HPA) axis. Ethanol administration activates the HPA axis. Acetaldehyde formed during ethanol metabolism in brain is able to activate the HPA axis at a central level.

Brain plays an important regulatory role in hepatic functions. The liver is richly innervated and signalling occurs between the liver and brain (Kerfoot et al., 2006). Liver dysfunction is associated with more extensive brain dysfunction in liver cirrhosis patients (Tarter et al., 1993). Brain monoamines and aldehyde dehydrogenase (ALDH) level together plays a decisive role in the ethanol addiction. The liver plays a primary role in body homeostasis. It regulates levels of circulating nutrients, excretes waste products into the bile, reduces circulating ammonia through production of urea, produces important serum proteins and produces bile acids required in digestion of lipids and acts as the primary site of metabolic defense. The ethanol induced neurotransmitters mediate changes in intracellular communications not only within the central nervous system but also in the peripheral tissues. The ethanol metabolism in the rat liver is functionally controlled directly by sympathetic nerves. With long-term use, adolescent rats
have shown massive neuronal loss in their cerebellum, basal forebrain and neocortex. Strong ethanol preferences are associated with reduced serotonergic functions either directly or indirectly by increasing dopamine neurotransmission particularly in the ventral striatum. Serotonergic system appears to be involved in ethanol consumption and reinforcement by activating dopaminergic reward system. Acetaldehyde produced from ethanol is metabolized quickly to acetate by liver ALDH. Biogenic aldehydes, the metabolic intermediate of ethanol, interfere in some way with the oxidative metabolism of the brain. Chronic ethanol exposure has been shown to cause degenerative changes in several areas of the brain, including cerebral cortex, hippocampus, cerebellum, brainstem and also in the peripheral nervous system. Acute ethanol intoxication may cause changes in hepatic enzymes (Hegyi et al., 2003).

Most of the acetaldehyde produced from ethanol is metabolized quickly to acetate by liver ALDH, the principal enzyme involved in serotonin and dopamine metabolism. The 5-hydroxyindole-3-acetaldehyde (5-HIAL), 3, 4-dihydroxyphenylacetaldehyde (DOPAL) are produced by the first step of metabolism of serotonin and dopamine respectively. Both DOPAL and 5-HIAL are excellent substrates for ALDH. Differences in acetaldehyde elimination may contribute to ethanol preference. Accumulation of acetaldehyde in blood following ethanol ingestion, due to a lower activity of ALDH, is believed to play a preventive role against ethanol addiction.

This study focuses on the effect of ethanol treatment and its functional correlation with dopaminergic and serotonergic system with regard to its suitability as a model of human ethanol consumption. The work that is presented
here is an attempt to understand the role of dopamine, serotonin acting through DA D₂ and 5-HT₂A receptors in the functional regulation of ALDH in ethanol treated rats. Neurobiological mechanisms that are responsible for ethanol addiction and the role of ALDH have been given special emphasis with dopamine and serotonin receptor subtype specificity. Also, the brain activity is studied using electroencephalogram confirming the neurotransmitters functional regulation and ethanol treatment.