Chapter 1

INTRODUCTION

The alcoholic beverages have a long history. The wines have been produced from juices of various fruits and consumed since ancient times. The wine consumption has been very popular in European countries for a very long time. However, in India the consumption of alcoholic liquors is more popular than that of wines. This is due to their greater intoxicating effect and lower price. The wines contain around 15 to 20% (v/v) ethyl alcohol, where as "liquors" being distilled product, contain 42.8% (v/v) ethanol[174]. In India, there are 285 distilleries producing 2645 million litres of alcohol annually[113]. Nearly 40% of this is consumed either as country liquor (CL) or as Indian made foreign liquor (IMFL), the rest being used as a chemical feed stock for alcohol based industries[162]. Being cheaper the country liquor is generally and frequently consumed by the weaker section of the society, mostly industrial workers and labourers. In the modern elite society also, the frequent consumption of liquor is becoming a common fashion.

Alcohol is a state excise subject and its production, storage, transportation and sale is under strict excise regulations. It has sometimes caused the illegal production, transport, sale and consumption of these liquors. Hence quite often there are seen some press reports regarding cases of blindness, severe illness and sometimes deaths of people resulting from consumption of illicit liquor. Even otherwise, alcoholism has been a problem for the society not only from the point of view of social disorder and crime, but from health point of view also. Therefore, alcohol consumption has attracted the attention of social workers and medical research workers for a long time.

1.1 What is Alcoholism ?

Alcoholism[172] is a chronic and usually progressive illness involving the excessive inappropriate ingestion of ethyl alcohol, whether in the form of familiar alcoholic

beverages or as a constituent of other substances. Alcoholism is thought to arise from a combination of a wide range of physiological, psychological, social and genetic factors. It is characterized by an emotional and often physical dependence on alcohol, and it frequently leads to brain damage or early death.

Some 10% of the adult drinkers in the United States are considered alcoholics or at least they experience drinking problems to some degree. More males than females are affected, but drinking among the young and among women is increasing. Consumption of alcohol is apparently on the rise in the United States, countries of the former Union of Soviet Socialist Republics, and many European nations. This is paralleled by growing evidence of increasing numbers of alcohol-related problems in other nations, including the third world.

The consumption of alcoholic liquors in India is in the form of country liquors and Indian made foreign liquors (IMFL) like rum, whisky, brandy, gin and vodka, etc. The former are prepared from unmaturated raw spirit and contain comparatively higher concentrations of chemical constituents like aldehydes, organic acids and higher alcohols which are significantly removed by double distillation or controlled distillation of spirit for production of IMFL. Further, the spirits used for IMFL production are quite sometimes either redistilled to silent spirit or they are aged/matured in wooden casks or barrels for several months or years, during which period many oxidizable substances like aldehydes and higher alcohols get oxidized into corresponding acids which ultimately react with ethanol to form esters, imparting a sweet and mallow taste to the liquors.

During maturation in wood, certain essential oils are also extracted out of wood into the spirits which impart an antiseptic effect to them. The country liquors may be plain, added with some synthetic fruit essences or spiced like Asha and Kesar Kasturi which contain extracts of many oriental spices in addition to 55% (v/v) ethyl alcohol and are famous brands of country liquor in Rajasthan.

Different chemical constituents present in alcoholic beverages/liquors include:

- Ethyl alcohol
- Propyl alcohol, Isopropyl alcohol, Butyl alcohol, Amyl alcohol and Isoamyl alcohol, collectively termed as fusel oil or higher alcohols.
- Acetaldehyde and other aldehyde
- Acetic acid and other organic acids
- Tartaric acid and other fixed acids, mostly present in wines.
- Ethyl acetate and other esters
- Other miscellaneous substances, like small quantities of methanol in some spirits.

The perusal of literature reveals that most of the work in the field of alcoholism has been carried out on the effect of ethyl alcohol on different organs of the body and almost no work has yet been reported on the effect of other chemical constituents of these liquors. In view of the foregoing, it was considered desirable to undertake the proposed study.

There has been an increasing awareness of the role of reactive oxygen species (ROS) in the biochemical changes associated with tissue injury in various diseases. Super oxide anion radical (O_2^-), hydroxyl radical (OH) and H_2O_2 formed during redox reactions in the biological systems, damage proteins including enzymes, cause breakdown of DNA strands and initiate peroxidation of polyunsaturated fatty acids in membranes leading to cell injury. Univalent reduction of O_2 to (O_2^-) is catalyzed by enzymes such as xanthine oxidase, aldehyde oxidase, flavin dehydrogenase, peroxidase, etc. and multienzyme systems such as mitochondrial electron transport chain and microsomal cytochrome P-450-dependent mixed function oxidases (MFO), which play an important role in the detoxication/toxication of xenobiotics (foreign chemicals) including drugs, pesticides, carcinogens and other environmental pollutants as well as in the metabolism of many endogenous compounds. Transition

metals $(Fe^{++}/Cu^{+})^{+}$ catalyzed decomposition of H_2O_2 and hydroperoxides and reaction between H_2O_2 and O_2^- generate highly reactive $^{\circ}OH$ radical. Under normal conditions, free radicals are formed in minute quantities and are rapidly degraded to comparatively harmless products by cellular defence mechanisms which involve superoxide dismutase, catalase and glutathione peroxidase.

Glutathione (L-γ-glutamyl-L-cysteinylglycine), a tripeptide in its reduced form (GSH) is a well known antioxidant which mediates various oxidation-reduction reactions within the body and thereby plays an important role in catalysis, metabolism and transport. GSH protects cell against free radical injury and toxic effects of chemicals of endogenous and exogenous origin. Lipid peroxides and H_2O_2 are detoxicated following reduction by glutathione peroxidase, where GSH is converted to oxidized glutathione (GSSG). Glutathione reductase (GR) catalyzes regeneration of GSH from GSSG in the presence of NADPH, which is produced during the reactions catalyzed by glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase.

1.2 Country Liquor constituents and Free Radicals

Cellular metabolism of ethanol produce short lived acetaldehyde, a strong free radical species. It is highly reactive and can form a schiff base linkages with proteins and other nitrogeneous macromolecules. The schiff base linkage is stable and forms a permanent acetaldehyde protein adduct rendering the cellular proteins inactive. This possibly may reduce the capacity of antioxidant defense system of the cell and presence of other aldehydes in Country Liquor and so called less harmful additives denaturants like Pyridine, Acetaldehyde, Catcouchicine etc. Other miscellaneous substances like methanol in Country Liquor may produce the highly reactive oxygen species causing the cellular damage.

Therefore, in the present study effect of Country Liquor on oxidative stress and its antioxidant defense system was investigated in the experimental model.