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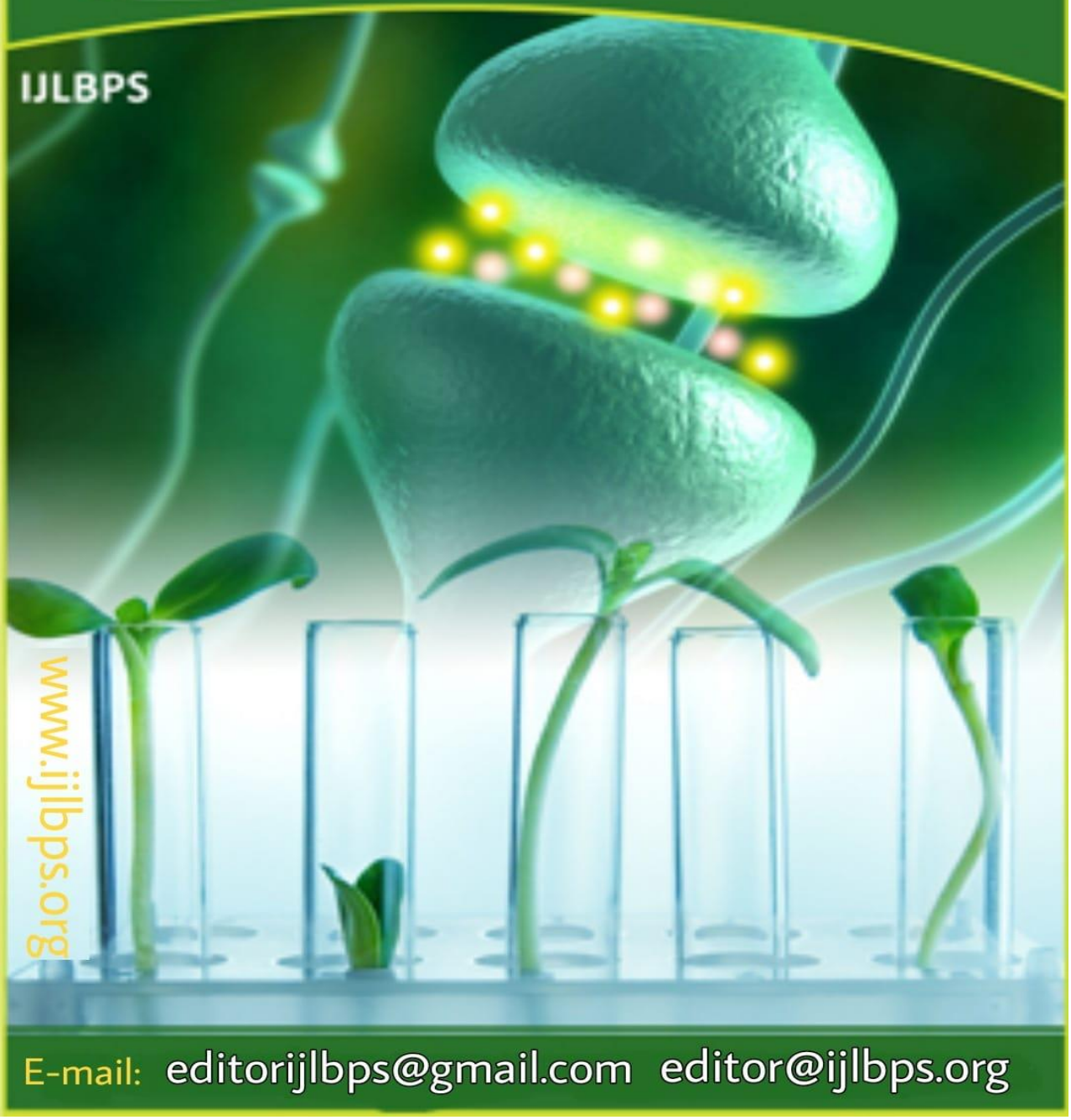

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A preliminary investigation on alterations in basic metabolic profiles to assess the possible effectiveness of dietary ginger on ethanol-induced oxidative stress in rat cardiac tissue.

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Abstract

This study set out to determine how ginger (Zingiber officinale) may shield rat heart cells from the damaging effects of alcohol. Total carbs, pyruvate, total proteins, free amino acids, and lactate levels were assessed in cardiac tissue to characterize the carbohydrate metabolic profiles. Rats that had consumed too much alcohol had significantly lower levels of free amino acids and lactate and significantly lower amounts of total carbs and pyruvate. Total glucose, protein, and pyruvate levels were found to be significantly higher in cardiac tissues treated with ginger (200 mg/kg body weight), whereas free amino acid and lactate levels were found to be significantly lower. The results of the current research suggest that ginger's high concentration of bioactive chemicals is responsible for its protective effect on cardiac tissue against alcohol poisoning in rats.

Key-Words: Alcohol, Ginger, Heart, Carbohydrate metabolic profiles, Rats

Introduction :

Alcohol is now the most widely acknowledged addictive substance in the world, according to a 2010 study by Guo and Ren. The American Psychiatric Association (1994) recognizes alcoholism as a chronic, debilitating brain disease. Heart disease (George & Figueredo, 2010), liver disease (Cederbaum et al., 2009), cancer (Seitz & Becker, 2007), and diabetes (Baliunas, 2009) are just some of the alcohol-related chronic diseases that have a high economic and human cost. There are many pathways for alcohol absorption in the digestive system (Holford, 1987). A strong preventive effect of moderate alcohol consumption against vascular disease has been shown (Mukamal et al., 2005). According to Lieber (1995), the anomalies in antioxidant, lipid, and carbohydrate metabolism are caused by acetaldehyde, one of the metabolites of alcohol metabolism, which affects the redox state in the cytosol. Several organs, including the heart (Regan, 1990) and the liver (Klein, & Harmjanz, 1975), show evidence of mitochondrial structure, function changes as a result of reactive oxygen species generated in alcohol poisoning (Robin, et al., 2005).

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Humans have relied on medicinal plants to treat a wide range of conditions since ancient times (Butt et al., 2009). Numerous studies have shown these natural items as being risk-free for human use. Ginger has a long history of usage as a medicine in Eastern medical traditions, including Ayurveda, Unani-Tibb, and Western allopathic medicine (Rong et al., 2009). Hypoglycemia, anticancer, anticardic, antirenal, hepatoprotective, and antioxidant are only some of ginger's pharmacological actions (Nicoll and Henein, 2009). There are several antioxidant components in ginger, which may reduce the production of free radicals or prevent their formation under harmful circumstances. Antioxidant activity has been shown in a number of models using ginger's active components, which include gingerols, shagogals, phytochemicals, and other compounds (Dugasani et al., 2010). In this particular research,a protocol to investigate ginger ethonolic extract's potential cardioprotective effects against alcohol-induced heart damage in rats.

Material and Methods

Ginger extracts preparationThe rhizomes of Zingiber officinale were purchased from local market in Tirupati with authenticated by botanist in the department of Botany, S.V.University, and Tirupati. The rhizomes were shade dried at room temperature and were crushed to powder. 120g of powder has taken and macerate in 1000 ml of 95% ethanol for 12 h at room temparture, then filtered and squeezed with muslin cloth to obtain ethanol extract juice. This process was repeated three times and finally collection of this juice were dried in rotary evaporator (Model:HS-2005V) from this we had get jelly and then this jelly was converted to powder in lyodel freezer. We has done dose dependent studies by using, 50 mg/kg, 100 mg/kg, 150 mg/kg, 200 mg/kg, 250 mg/kg and 300 mg/kg. of this 200 mg/kg dose showed good antioxidant activity. So this study we selected dose of 200 mg/kg of ethanol extract of ginger.Animals and treatmentsThe study was approved by Institutional Animal Ethics Committee (IAEC) [Reg No: 10/i/a/CPCSEA/IAEC/SVU/KSR-GVS/dt 15/11/2011].Twenty four Wistar male albino rats weighting 200 ± 25 g were used. They obtained from Indian Institute of Science, Bangalore. Animals were kept in laboratory at constant room temperature (26 ± 20C) at least one week before and throughout the experimental period. Commerical pellet diet and water were provided ad libitum. After acclimatization 24 rats were divided into four groups of 6 animals each and treated as follows: Group I: Normal control (NC): rats received 2 % of Tween- 80 in normal saline. Group II: Ginger treatment (Gt) : rats received ethanol extract of ginger (200 mg/kg body wt) orally for 30 days. Group III: Alcohol treatment (At) : rats received alcohol at dose of 2g/kg for 30 days. Group IV: Ginger+Alcohol treatment (At+Gt) : rats received ginger for 30 days followed by alcohol (2g/kg) for 30 days. At the end of 30 days treatment period, the rats were sacrificed by cervical dislocation and heart tissues were isolated, washed with ice cold saline, immersed in liquid nitrogen and stored in deep freezer at -800C for further biochemical analysis. The carbohydrate metabolic profiles such as total proteins, total carbohydrates, total free amino acids, pyruvate and lactate levels were estimated in cardiac tissue by the methods of Lowry et al., 1951,Carroll et al., 1956 ,Moore and Stein,1954, Friedmann and Hangen, 1942 and Barker andSummerson (1941) as modified by Huckabee 1961 respectively.ChemicalsIn the present study all chemicals used were of Analar Grade (AR) and purchased from the following scientific companies: Sigma (St.Louis, MO, USA), Fischer (Pitrsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India).

Statistical analysisThe data has been analyzed by using SPSS (Version 16.0; SPSS Inc., Chicago, IL, USA) and M.S. Office, Excel Software for the significance of the main effects (factors), and treatments along with their interactions. The data has been compared using one way ANOVA with

Dunnett's multiple comparison test and differences were considered significant at $p < 0.05$.Results and DiscussionGinger phenol compounds like gingerols, shagogals Possesses antioxidant properties due to their free radical scavenging activities. (Stadtman, 2004; Siddaraju & Dharmesh, 2007; Shanmugam et al., 2010). Ginger has been used to cure diarrhea, dysentery, fever, cough, ulcers boils and wounds (Young, HV et al., 2005). Ajith et al., (2007) reported that ginger ameliorat cisplatin- induced nephrotoxicity. A combination of ginger and garlic has been reported to produce hypoglycemic and hypolipidemic effects. In another study ginger has protected the tissue from oxidative stress.The data obtained from our study demonstrate that total proteins (Figure D) were significantly decreased in the alcohol treated rats than normal control group; meanwhile total proteins were increased in the ginger treated group compared to ethanol group. Proteins are most important to maintain the structure of the body. Feinman, 1998 & Lieber, 2003 reported that in alcohol subjects, protein levels are decreased. Chronic exposure of rats to a diet containing ethanol inhibit the protein synthesis as result of declined messenger RNA translation consecutively 25% loss in cardiac protein per heart (Vary et al., 2001). The major ethanol metabolite acetaldehyde may contribute to cardiac dysfunction, hypertrophy and heart failure by either its direct toxicity or promoting elevated levels of catecholamines and reactive oxygen species (ROS) (Zhang et al., 2010). Although, alcohol metabolite acetaldehyde has cytotoxic effect within the cells or tissues due to reacting with nucleic acids, proteins, peptides, amino acids, lipids and carbohydrates (Bartsch and Nair, 2000). Other early reports also implicated enhance lipid peroxidation or generation ROS could results reduces the tissue protein synthesis (Matias et al., 1999). On the other hand total proteinlevels are increased in ginger treated and ginger treatment in alcoholic rats. Many reports confirmed that ginger's antioxidant activity. Siddaraju and Dharmesh (2007) reported that ginger-free phenolic and ginger hydrolysed phenolic fractions exhibited free radical scavenging activity. Thus ginger prevented the oxidative modification of proteins by it antioxidant property.The variations in carbohydrates and pyruvate levels in cardiac tissue are shown in figure B and C. There was a significant decrease ($P<0.05$) in the carbohydrate and pyruvate levels in ethanol treated rats when compared to normal control rats. Alcohol metabolites acetaldehyde, acetate and their end product acetyl CoA levels were increases NADH/NAD+ ratio, which reflects to deplete the glycogen levels due to a blockage of gluconeogenesis in the hepatic tissue (Lieber, 1991). Randle et al., (1988) has confirmed that actyle CoA inhibits the pyruvate dehydrogenase in alcoholic subjects, so in our study pyruvate levels also decreased in ethanol subjects. Alcohol metabolism increases the NADH levels resulting to induce the lactate dehydrogenase activity (Phyper & Tom Pierce 2006). On the other hand alcohol metabolite acetaldehyde induced the insulin resistance to the cardiac tissue which reflect on variety metabolic abnormalities such as hyper lactacidemia, inhibit the lipolysis in adipocytes (Caballena, 2003) which resulting in decreased levels of the pyruvate in alcohol subjects. However with ginger treatment in ethanolic rats, carbohydrates and pyruvate levels are increased. Shanmugam et al., (2009) have been established that ginger modulates the pyruvate and carbohydrate levels in diabetic rats. Our results were confined to above reports, due to the bioactive compounds in ginger, these compounds may increase the levels of carbohydrates and pyruvate in ethanol treated rats.There was a significant increase ($P<0.05$) in the lactatedemonstrated that alcohol upshot on NADH/NAD+ ratio which fallouts cellular redox state in turn increases lactate/ pyruvate ratio results in hyperlactedimia (Greenway & Lautt 1990). Oxygen radicals and other ROS alter the proteins (Grune, 1997). These oxidative modifications may lead to changes in protein function, chemical fragmentation, or increased susceptibility to proteolytic attack (Freeman, 1982). The previous reports also demonstrated

that chronic alcohol consumption can increases amino acids levels in alcoholic patients (Bleich et al., 2004). Ginger intentionally condensed the proteolytic process and increases the gluconeogenesis (Chakraborty et al.,2012), hence in ethanol treated rats with ginger treatment free amino acids levels are decreased.Whereas ginger treatment decreases the levels of lactate and free amino acids compared to ethanol treatment group. Nevertheless, ginger has convalesced the cellular redox state by decreasing the NADH/NAD+ ratio consequential reduced the free radicals by its antioxidant property (Shanmugam et al., 2010). Dugasani et al., (2010) have been reported that bioactive compounds of ginger like gingerol has antioxidant activity in various experimental modules.(Morakinyo et al., 2011). Similar consequences were may be occur in our study, so lactate and free amino acid levels are decreased in ginger treated group when compared to ethanol treated group.

Conculsion:

In this work, we determined how ginger affected carbohydrate metabolic profiles in relation to alcohol toxicity. Isolating bioactive molecules and investigating their potential significance in alcohol-induced myocardial infarction are two avenues for further study.

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