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**Full Length Research.**

# INTERPERITONEAL VS ORAL ROUTE OF ALCOHOL ADMINISTRATION,WHICH IS BETTER?

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**The major problem researchers of alcohol intoxication and its dependence face is the route of administration as animals though good do not mimic the perfect subjects i.e. human beings. This study however compares between 2 accepted means of alcohol intoxication namely interperitoneal (i.p) and oral (o.r) routes.**

**A total of 24 Rats were divided into 4 groups vis-à-vis (a) oral group administered with 63mg (10%) and 130mg (20%) ethanol kg-1 body weight (chronic) for a period of 14 days and concomitantly, the intraperitoneal group, injected with 130mg (20%) ethanol kg-1 body weight for a period of 7 days (acute) and lastly the control group injected with normal saline as the body weight dictated. After this period of intoxication the following biochemical parameters were determined ALT, AST, Cholesterol and Electrolyte balance.**

**Ethanol intoxicated rats (chronic and acute) recorded a significant increase in serum aspartate (AST) and Alanine (ALT) amino transferase activities, cholesterol, and a decrease in electrolyte (potassium) the elevation in total protein was not significant with the i.p group showing the highest elevations.**

**Hence, aspartate (AST) and alanine (ALT) aminotransferase, cholesterol, electrolyte estimation (potassium) may be used as biomarkers for the early diagnosis of ethanol toxicity in human beings.**

**Keywords**: alcohol intoxication, Biochemical parameters, ALT and AST

## INTRODUCTION

Over the centuries, alcohol has been widely used on earth as drugs. Its use predates recorded history and may go back as far as the Paleolithic age around 8000B.C.( Brick,2005).In the last decades, neuroscience has significantly increased our understanding of the neuropharmacological effects of alcohol. As a psychoactive drug, alcohol induces changes in brain chemistry to produce a wide range of behaviors(Crews,2003).Alcohol is commonly referred to as ethyl alcohol and or ethanol. Ethanol is found associated with varieties of our cultural life and various name have been attached to it, for instance, whisky in Gaelic,water of life, Sapele water, gin, ogogoro, ojuna, among others has been given to alcohol in various societies.

Alcohol is formed naturally from carbohydrate when certain micro-organism metabolizes carbohydrate in the absence of oxygen, a process called fermentation(Osei ,2005). It was reported that honey furnished the first drinkable alcohol in nature (Boggan,2001) and alcohol shares with caffeine as well as nicotine the distinction of being among the three widely used drugs in the world (Vincent,1983). Alcohol a relatively simple compound, with the general chemical formula $C_2H_5OH$ is a clear, relatively odorless liquid that is infinitely miscible in water. Alcohol is not digested like other food the reason lie in the fact that it avoids the normal digestive process and goes directly to the blood stream(Levitt and Levitt,1994). The metabolism of ethanol goes thus: ethanol is first broken down to acetaldehyde a reaction carried out by alcohol dehydrogenase and then further broken down and finally to carbon iv oxide and water (Brick, 2003).The absorption of alcohol is greatly affected when consumed with some food specifically fatty foods(Horowitz *et al.*,1989). It had been reported that the maximum absorption is achieved with the consumption of alcohol on an empty stomach(Levitt,1997). These toxic metabolic effects of ethanol oxidation are as a result of i. increased liberation of Reduced Oxidized Substrate (ROS) ii. Production of deleterious active acetaldehyde
iii. Increased NADH/ $NAD^+$ ratio
iv. disturbance of intracellular calcium store (Lieber, 2000; Soliman *et al.*, 2006). It has also been reported that ethanol intoxicated rats recorded a significant

increase in Aspartate amino transferase (AST) and Alanine amino transferase (ALT) respectively.

An evidence shows that, ethanol drinking in animal is an operant response which can be modified by the same manipulations as any other operant response (Amit and Stern,1969) .It has shown that voluntary alcohol consumption has anxiolytic effects in rats(Gallate et al.,2003) and in humans (Hershon,1977). The temporal parameters used in studies of alcohol dependence are often dependence. Animals show signs of alcohol dependence in as few as 2 to 3 weeks using CIE vapor inhalation(O'Dell *et al.*,2004) , but this threshold vapor exposure time doubles in chronic continuous vapor procedures (Roberts *et al.*, 1999).

Ethanol, the subject of this study, is the alcohol in alcohol beverages consumed by many people.

The harmful effect of alcohol cannot be over emphasized on human body. This present study compared between two different alcohol intoxication routes vis-à-vis intraperitoneal and free access methods.

**EXPERIMENTAL DESIGN**

Rats were orally administered with 0.063g (10%) and 0.13g (20%) ethanol kg-1 body weight (chronic) for a period of 14 days and concomitantly, the third group of animal were interperitoneally, injected with 1.3g ethanol kg-1 body weight for a period of 7 days (acute).

**SAMPLE PREPARATION**

Serum sample: Blood collected from cardiac puncture was dispensed gently into heparinized bottle and gently mixed by turning upside down. The blood was centrifuged at 3000 rpm for 5 minutes for serum separation. The separated serum was stored at -20$^0$C for further analysis.

**BIOCHEMICAL PARAMETERS INVESTIGATED**

AST and ALT using Gella *et a*l.,(1985).

**SERUM PROTEIN**

Estimation of Serum /Plasma Protein Using Reinhold method (Reinhold ,1953).

**CHOLESTEROL**

The method of Kettermann *et al.,*(1984) was adapted for this study

**ELECTROLYTES**

The method of Vogel(1962) was adapted for this study.

**RESULTS**

The results obtained from the parameters analyzed in this study are presented in the table below:

**Table 1:** Showing investigated Biochemical Parameters

| Parameters | Control 0.85NS | Group I 10% ET (OR) | Group II 20% ET(OR) | Group III 20% ET (IP) |
|---|---|---|---|---|
| Cholesterol (mmol/l | 2.04 + 0.40 | 1.90 ± 0.50 | 2.20 ± 0.58 | 3.10 ± 0.40 |
| Total protein (g/L) | 77.14±50 | 67.10±1.80 | 80.23±2.70 | 82.26±1.10 |
| AST (u/L) | 177.00±2.90 | 176.14±2.60 | 180.50±1.60 | 183.10±3.50 |
| ALT (u /L) | 116.±3.20 | 118.60±2.20 | 123.30±1.40 | 141.70±5.00 |
| Potassium K+(mmol/L) | 4.36±0.50 | 4.82±0.90 | 4.50±0.56 | 3.76±0.76 |

Table: - shows the mean (X) and standard deviation (SD) of the analyzed parameters

Where

NS => Normal saline

ET => Ethanol solution

OR => Oral route administration

IP =>Intraperitoneal injection

**Table 2** shows the mean weight (g) of the animal (Sprague Dawley rats) before and after administration of ethanol solution of various concentrations.

| Weight | Control | Group I | Group II | Group III |
|---|---|---|---|---|
| **WBAE** (g) | 170.00±18.70 | 160 ± 20.0 | 150 ± 13.0 | 150 ± 13.0 |
| **WAAE** (g) | 185 ± 10.0 | 180 ± 5.0 | 155 ± 6.0 | 160 ± 3.0 |

Where

**WBAE** – Weight of rats before administration of ethanol solution

**WAAE** – Weight of rats after administration of ethanol solution

**GRAPHICAL PRESENTATION OF THE DATA**
The data obtained from each analysis were presented in bar chart below.

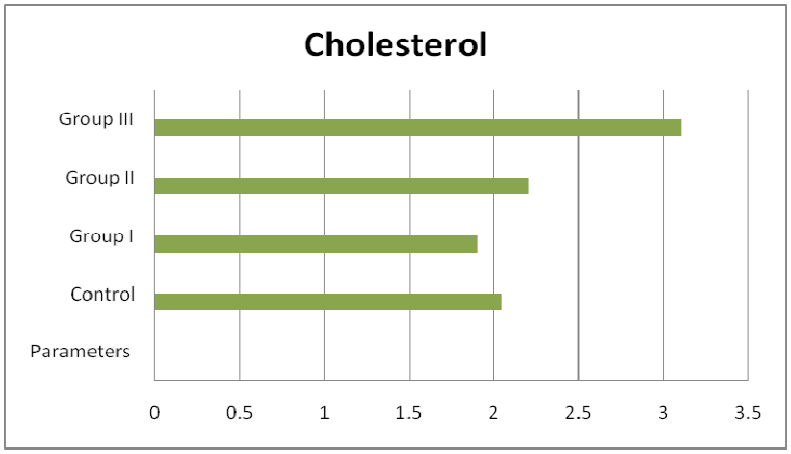


**Fig 1:** Effect of ethanol intoxication on serum cholesterol
Data are mean ± SD of five normal and fifteen intoxicated rats.

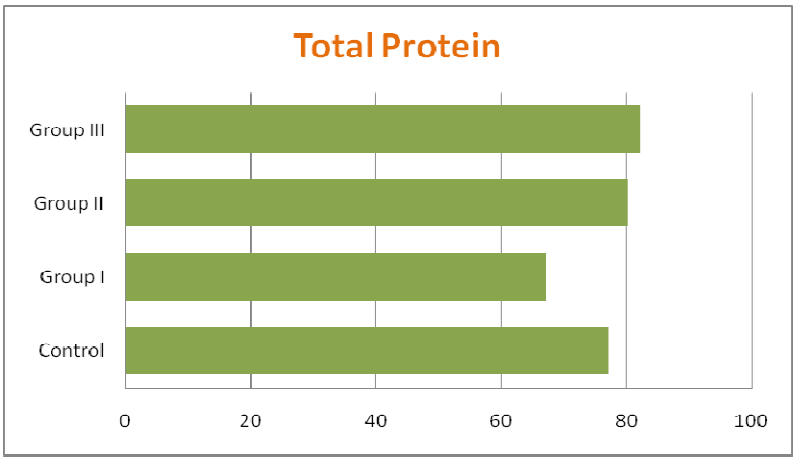


**Fig 2:** Effect of ethanol intoxication on serum total protein
Data are mean ± SD of five normal and fifteen intoxicated rats.

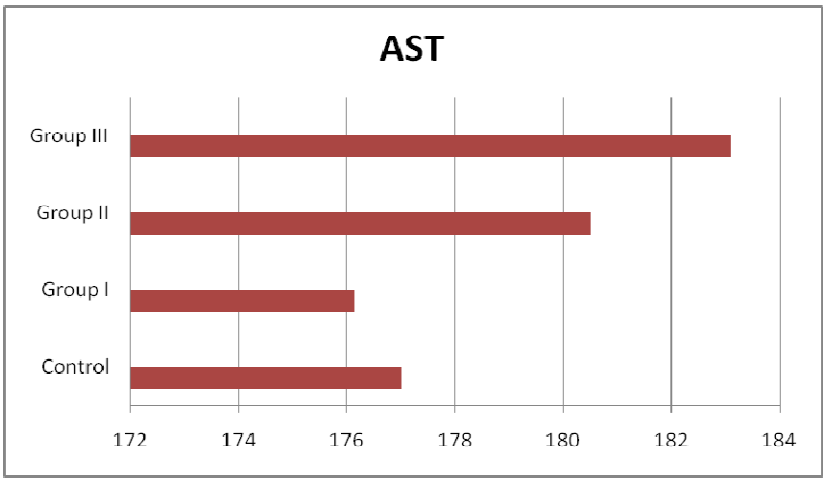


**Fig 3**. Effect of ethanol intoxication on serum Aspartate amino transferase (AST).
Data are mean ± SD of five normal and fifteen intoxicated rats

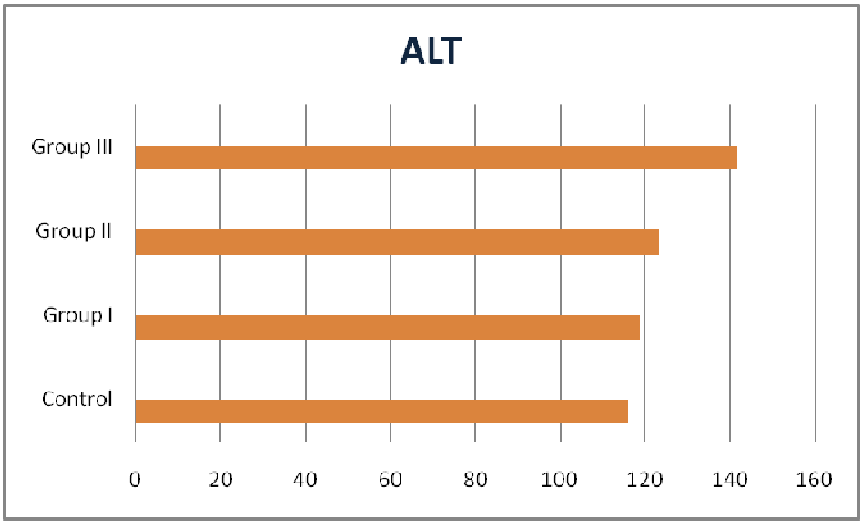


**Fig 4:** Effect of ethanol intoxication on serum Alanine amino transferase (ALT).
Data are mean ± SD of five normal and fifteen intoxicated rats

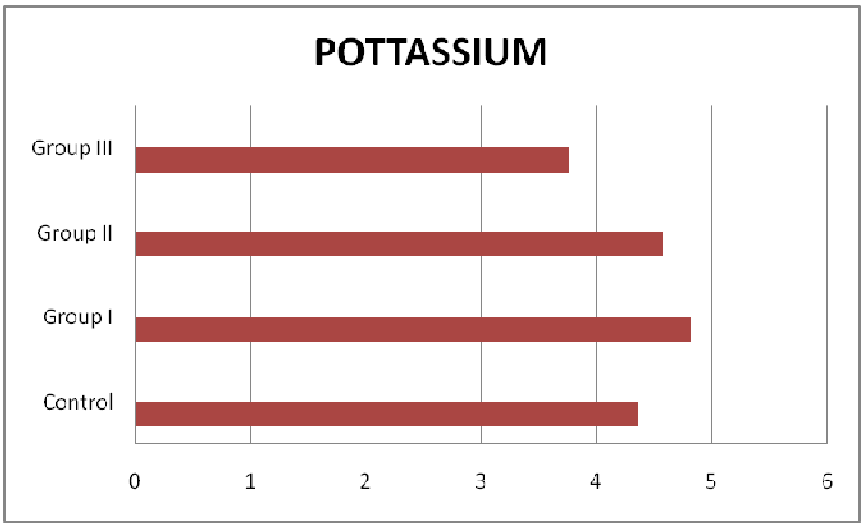


**Fig 5**: Effect of ethanol intoxication on serum electrolyte (potassium).
Data are mean ± SD of five normal and fifteen intoxicated rats.

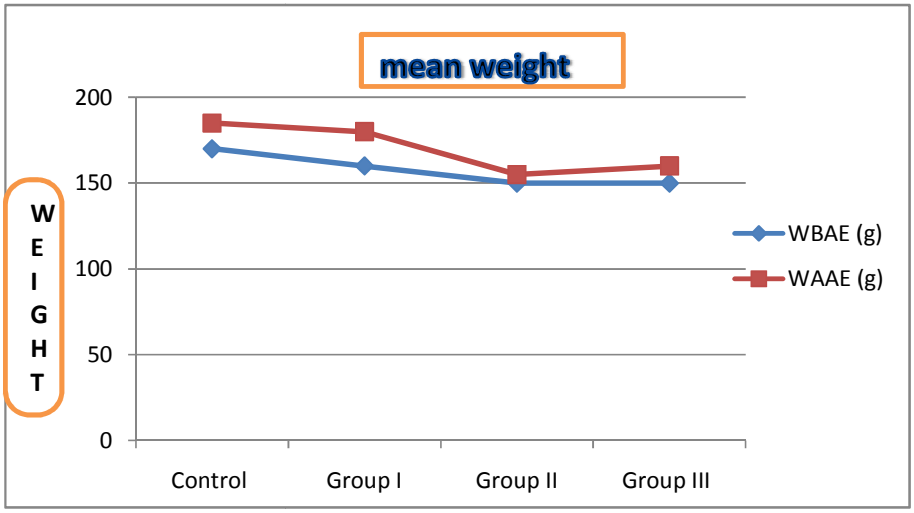


**Fig 6:** Weight of rats before and after administration of alcohol

## DISCUSSION

In this study, ethanol intoxicated rats recorded significant increase in cholesterol level (1.9 ± 0.50, 2.20 0.50, 2.20 ±0.50 and 3.10 ± 0.40mmol/l) when compared to the control group rats (2.04 ± 0.40 mmol/L; Fig.1) with the i.p group i.e group III rats having the highest levels.This elevated level of cholesterol may be due to the fact that ethanol affects some intermediate in cholesterol biosynthesis and it lead to the precipitation of cholesterol in the serum.[21] For more positive clarifications further studies on effect of alcohol intoxication on cholesterol biosynthesis would be a welcome delight.

Moreso, the result of the study revealed that ethanol intoxicated rats recorded a significant increase in Aspartate Amino Transferase (AST), (176.14 ± 2.60, 180.50 ± 1.60 and 183.10 ± 3.50U/L). Alanine Amino transferase (ALT), (118.60 ± 2.20, 123.30 ± 1.40 and 141.70 ± 5.00U/L) by AST (0.6%, 80% and 83%) and ALT (1.5%, 5.6% and 21.0%) followed the administration of various concentration of ethanol solution (Fig.3 and 4) also with the i.p group having the highest concentrations.

In agreement with this present study, Chen *et al.,*(2003) observed a significant increase in AST and ALT after light/moderate drinkers (at least once per month < 210g ethanol/week for men; instead of, < 140g ethanol per week for women). In addition, Onyesom and Anosike (2007) recorded elevation in AST and ALT in rabbits orally given 1.5g ethanol $kg^{-1}$ body weight as singe daily dose for a period of one week. Further studies by Chen *et al*.,(2003) stated that AST and ALT are specific enzymes for detecting intoxication and monitoring liver diseases.

Although, ethanol intoxication affects liver cells, the elevation in total protein was not significant due to the fact that the reduction in liver albumin was compensated by globulin their by keeping the total protein within a fairly constant state (Fig. 2). In agreement with the present result, Yang *et al.,*2005 observed that ethanol interpolates and expands biological membranes leading to increase membrane fluidity and enzymes release which invariably keeping the serum total protein at fairly constant.

Also, the study shows that ethanol posed danger to our body electrolyte principally and potassium ($K^+$). The study recorded a slight decreased in intracellular potassium ions concentration by (13.8%, 10.5% and 3.2%) followed the administration of ethanol solution of various concentrations. In agreement with this study, Yang *et al.,*(2005) observed that an increase in membranes porosity was due to the effect of ethanol that interpolates and expands biomembranes leading to increase membrane fluidity and release of intracellular constituent.

In the present study, the weight (160 ± 20, 150 ± 3, 150 ± 13g) in intoxicated rats recorded a significant decrease by 6.3%, 3.3%, 6.65-7% as compared to normal healthy rats (Fig 6 ), however this weight increase was across all groups with no specifications to either i.p or o.r. This was in accordance with clinical study of Agbaje (2004) who observed a significant decrease in weight of human beings followed consumption of alcohol drinks four weeks of three drinks per day. The weight of the rats was determined by measuring the initial weight before the commencement of the experiment and 24 hours to the end of experiment.

The results demonstrated that the intraperitoneal injection of ethanol solution was highly specific in terms of its comparison with oral route administration and could be used as a mode of studying the ethanol toxicity in animals (Sprague Dawley rats) model of determine human voluntary consumption .

The results of the experiment showed that intraperitoneal group (acute) recorded a significant increase in aspartate (AST) and alanine (ALT) amino transferase and cholesterol in comparison with the oral route (chronic) mode of administration. Hence, the intraperitoneal injection of ethanol solution to rats could be used as a model for human voluntary consumption of alcoholic drinks, however there are no certainties to this point because in determining human voluntary consumption a lot of other test batteries are needed. Also, an extension of the experiment could be done to include other parameters like behavioral determinations e.g. the rotarod test and more biochemical tests are also needed e.g. GGT and MCV determinations. Maybe after all these tests have been done a more conclusive statement could be made.

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