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Article

Attenuating Effects of *Cocos nucifera* Water on Alcohol-Induced Liver Enzyme Derangement and Hepatopathological Changes

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Abstract: Hepatic disorders are common in alcoholics. Alcohol is almost entirely metabolized in the liver and the elevation of the liver enzyme makers are used to assess the physiological/pathological state of the liver. In the present study, the attenuating effects of *Cocos nucifera* water in alcohol-induced hepatotoxicity and hepatopathological changes were studied in wistar rats. A total of thirty (30) albino wistar rats were randomly divided into five (5) experimental groups of six rats each. Group 1 (control) was fed with rat chow and water ad libitum. Group 2, 3, 4 and 5 were given 0.015mg/kg body weight of 25% alcohol, and group 3, 4, and 5 were treated with 1ml, 2ml and ad libitum concentration of *Cocos nucifera* water respectively for 6 weeks. The result shows a significant ($P< 0.05$) increase in ALT, AST, ALP, γ-GT and unconjugated bilirubin in the alcohol only group (Group 2) compared to control and also a dose-dependenet significant ($p< 0.05$) decrease in the markers compared to alcohol only treated group (Group 2). Furthermore, histological studies showed a repair of the infiltration with cells of chronic inflammation and fatty liver caused by treatment with alcohol. These findings need to be further studied to confirm its suitability as an alternative in the management of alcohol-induced liver injury.

Keywords: Alcohol, hepatotoxicity, *Cocos nucifera*, Liver enzymes.

1. Introduction

Alcohol is a group of colourless, volatile, flammable organic compounds containing one or more hydroxyl (-OH) groups, bonded to an alkyl group. It is obtained by fractional distillation, hydration of ethylene or by fermentation of sugar containing substances such as fruits, grapes etc. (Onyesom and Atakuo, 1998)

Ethanol is the form that is present in most beverages and administered orally by drinking. It is easily absorbed when ingested within the body fluid compartments (Onyesom et al., 2007)

Most of the alcohol that people drink is metabolized in the liver, a number of potentially dangerous by-products is generated (Maher, 1997). The major pathway for alcohol metabolism involves oxidation reaction catalysed by the enzyme alcohol dehydrogenase (ADh), the microsomal enzyme oxidizing system (MEOS) (alternate pathway of metabolism) and possibly Catalase (rarely in haman). (Lieber, 1994) with accompanied production of $NADH + H^+$

From the era of ancient man, there has always been interaction between man and his environment and this had led to the establishment of relationships. Such relationship could either be beneficial or detrimental. The ancient man had little knowledge of the medicinal value of natural products, which he discovered by trial and error or by accidental observations of the discriminatory use of these plants by animals. Thus, by testing herbs, people began to acquire some rudimentary knowledge about medicine and pharmacology (Wakang, 1985)

Coconut plant belongs to the family of the Palmae, the tribe Cocoideae and to the genus *Cocos nucifera.* The water of tender coconut, technically the liquid endosperm, is the most delicious and nutritious wholesome beverage that nature has provided for the people of the tropics to fight the sultry heat. It has a caloric value of 17.4/100gm. Coconut water contain sugars, vitamins, minerals, proteins, free amino acids and growth promoting factors (Muanya, 2009). It has numerous medicinal properties which according to (Osim and Dikko, 1990) includes good drink for cholera patients because of its saline and albumen content; checking urinary infection, and diarrhea; effective in the treatment of kidney and urethral stones; aiding in quick absorption of drugs and makes their peak concentration in the blood easier by its electrolytic effects; it is a urinary antiseptic and eliminates poisons in case of mineral poisoning (Osim and Dikko, 1990)

Also, coconut water is believed to be an antidote to ill effects of drugs. Recently, it is reported that Nigerian researchers have also confirmed the blood glucose lowering effects of coconut water, and have recommended it for the management of diabetes (Effiong et al., 2010).

Cocus nucifera (coconut) is traditionally recognized for its medicinal properties among several other uses. The use of coconut water to counteract poisons is a common practice in India, Africa and Nigeria in particular. It has severally been used as an immediate remedy for drug over dosage effects

(Effiong et al., 2010). This study is therefore aimed at evaluating the effect of coconut water on liver enzymes marker and histology of alcohol treated wistar rats.

2. Materials and Methods

2.1 Animals

Thirty (30) experimental animals (rats) were obtained from the Animal House of College of Health Sciences, Delta State University, Abraka, Delta State, Nigeria, weighting 150-200g were used. The rats were randomized into five (5) groups of 6 rats each and housed in stainless steel cages and a twelve-hour light/dark cycle was maintained.

They were allowed access to water and feed (product of Bendel Feed and Flour Mills, Ewu, Nigeria Ltd.) ad libitum throughout the period of the experiment.

2.2 Plant Materials

Ten green coconuts of various ages were harvested from different coconut trees in Abraka, Ethiope East Local Government area of Delta State. Botanical identity was kindly confirmed by a staff in the Department of Botany, Delta State University, Delta State, Nigeria. The husks were peeled off. Prior to administration, the shell was cracked and the coconut water extracted into sterile containers.

2.3 Experimental design

The Coconut water and alcohol were administered orally slowly using an orogastric cannula inserted into the mouth of the rats to ensure that the measured volume is completely delivered.

Group 1	(Control) fed on normal rat chow and tap water ad libitum
Group 2	Received 0.015mg/kg of 25% alchohol
Group 3	Received 0.015mg/kg of 25% alchohol + 1ml of Cocos nucifera water
Group 4	Received 0.015mg/kg of 25% alchohol + 2ml of Cocos nucifera water
Group 5	Received 0.015mg/kg of 25% alchohol + Cocos nucifera water ad libitum

2.4 Laboratory assays

The animals were sacrificed 24 hours after the last drug administration and immediately blood was collected and transferred into a centrifuge tube and allowed to clot for 30 min before centrifuging for 5 min using Wisperfuge model 1384 centrifuge (Tamson, Holland). The serum obtained after centrifugation was used for the estimation of liver enzymes. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities were assayed using the colorimetric method of Reitman and Frankel (1957). Alkaline phosphatase was estimated using the colorimetric method of King and

Armstrong (King and Armstrong, 1934), Gamma Glutanyl transferase (γ-GT) by colorimetric coupled enzyme assay using glutathione as substrate by Del corso et al., 2006.

2.5 Statistical Analysis

All results were expressed as mean ± standard deviation. One-way ANOVA was used to statistically analyze the results of the study. *P*- value <0.05 is considered significant

3. Results

In this experiment, changes in the mean level of the liver function enzymes were determined. The liver function enzymes level of Coconut water treated rats were compared to those of the control rats over a period of four weeks this was to ascertain the effect.

Table 1: Effect of *Cocos nucifera* Water on Serum Liver Enzyme parameters

Parameters	**Control**	**Group 2**	**Group 3**	**Group 4**	**Group 5**
ALT (IU/L)	19.02 ± 0.22	51.95 ± 1.29	34.44 ± 4.27	28.41 ± 0.17	26.12 ± 0.88
AST (IU/L)	22.60 ± 1.54	56.08 ± 0.32	38.11 ± 2.21	32.55 ± 0.62	4.52 ± 0.88
ALP (IU/L)	48.24 ± 0.84	88.22 ± 0.53	79.02 ± 1.55	62.08 ± 2.62	60.11 ± 1.23
γ-GT (IU/L)	20.05 ± 2.25	80.06 ± 3.25	56.08 ± 2.25	32.08 ± 4.06	30.06 ± 2.25
Total Bilirubin Mg/dl	0.21 ± 0.52	0.52 ± 0.26	0.31 ± 0.55	0.28 ± 0.29	0.29 ± 0.19
Unconjugated Bilirubin Mg/dl	0.12 ± 0.11	0.43 ± 0.55	0.21 ± 0.72	0.19 ± 0.22	0.20 ± 1.25

Values are presented as means ± SD; *P < 0.05 compared with control group. (n=15)

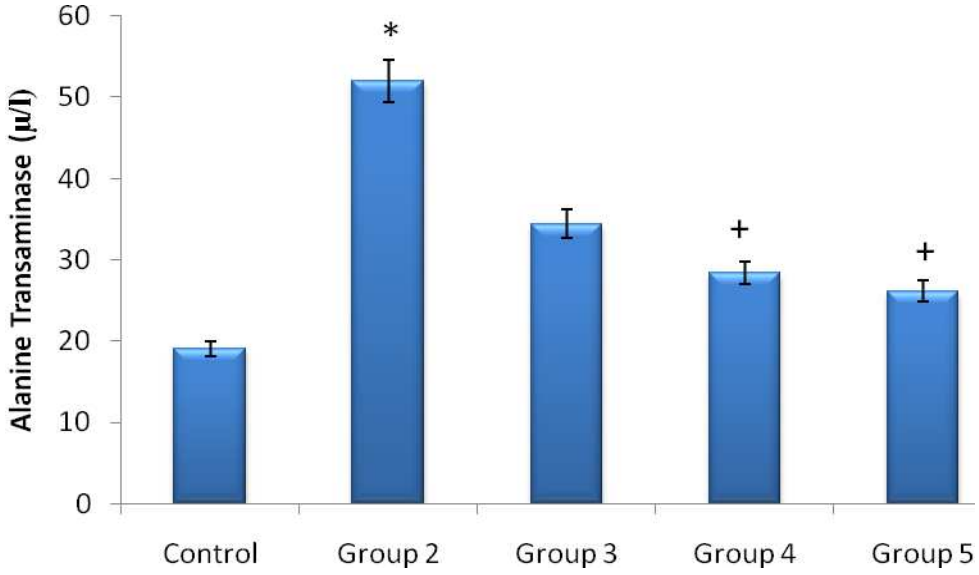

Fig 1: Effect of *Cocos nucifera* on Alanine Aminotransferase (ALT) in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

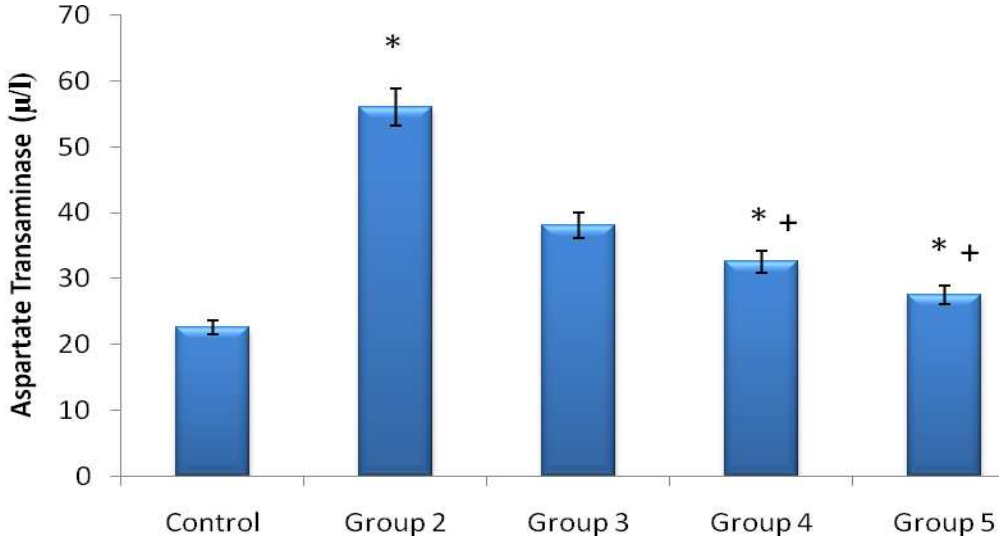

Fig 2: Effect of *Cocos nucifera* on Aspartate Aminotransferase (AST) in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

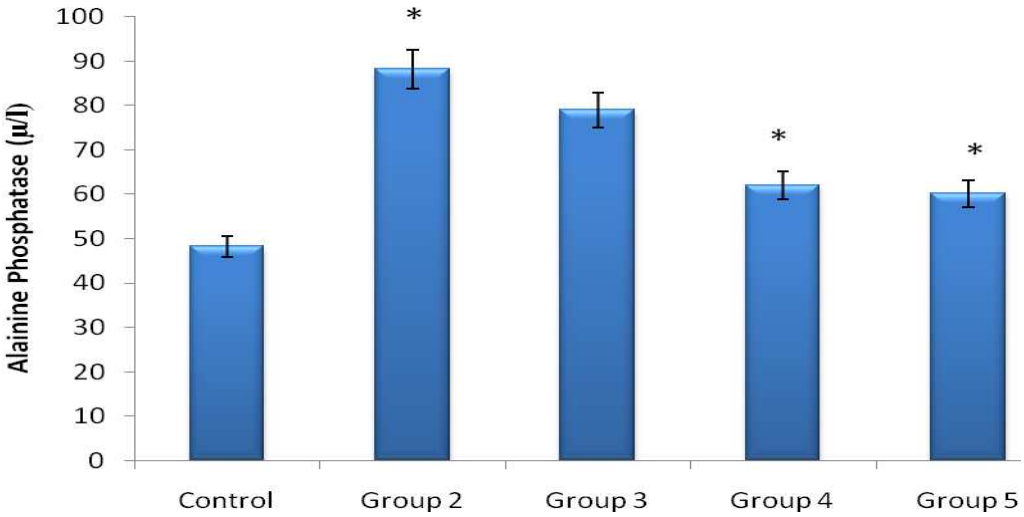

Fig 3: Effect of *Cocos nucifera* on Alanine Phosphatase (ALP) in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

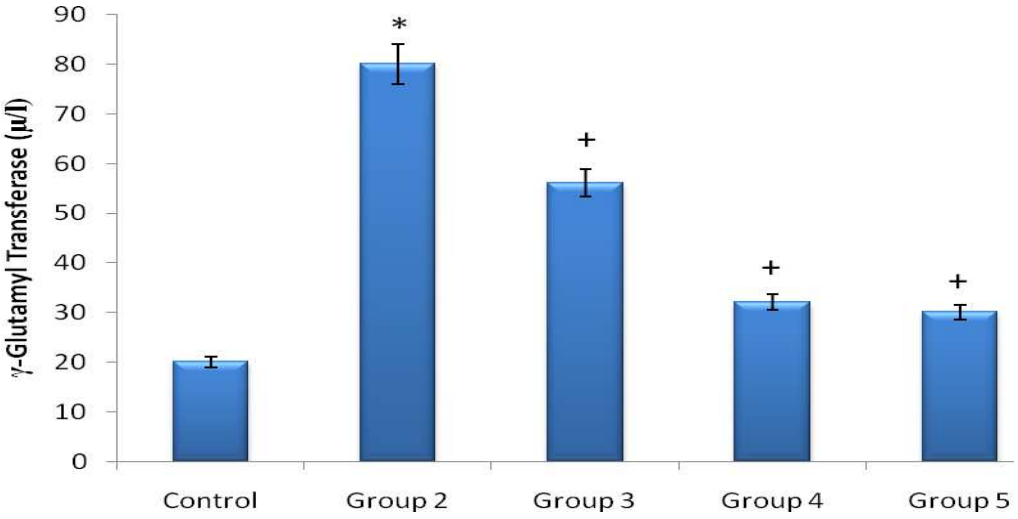

Fig 4: Effect of *Cocos nucifera* on Gamma Glutanyl Transferase (γ-GT) in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

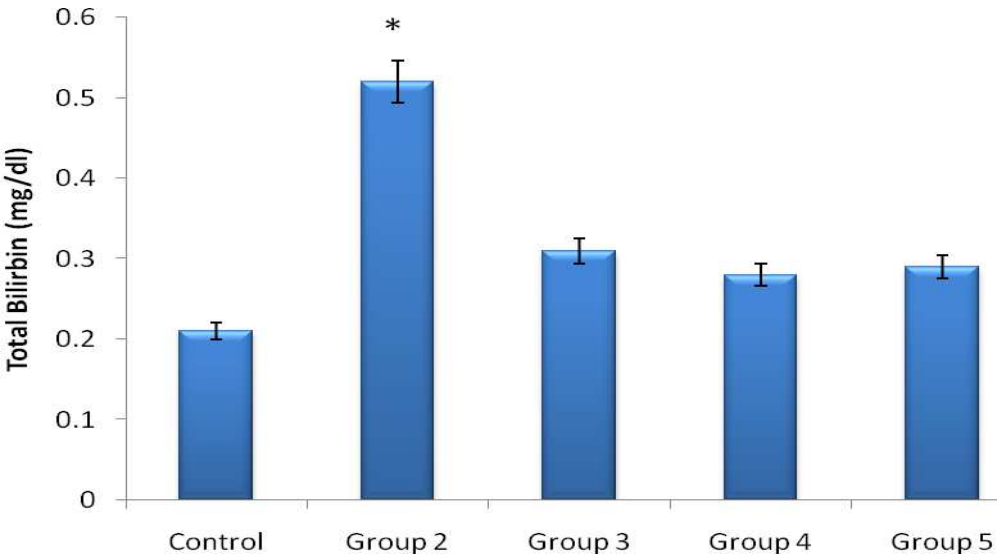

Fig 5: Effect of *Cocos nucifera* on Total Bilirubin in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

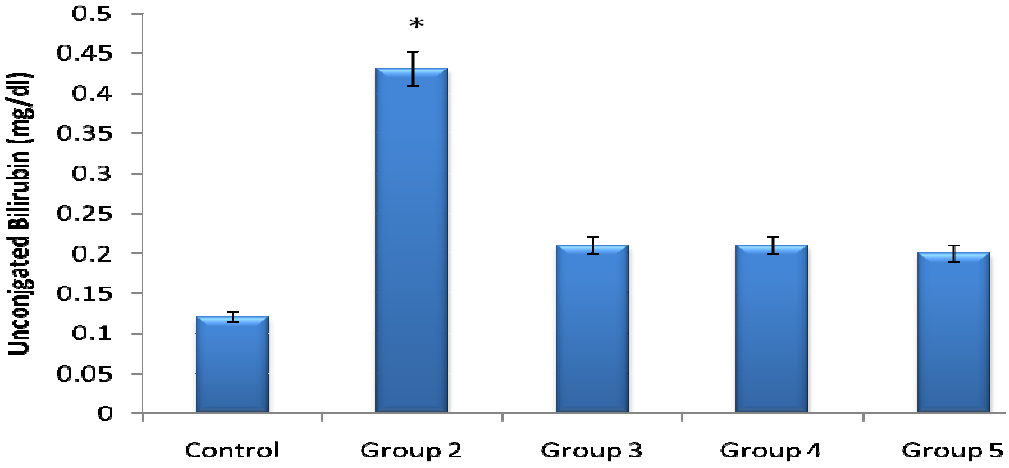

Fig 6 Effect of *Cocos nucifera* on Unconjugated Bilirubin in Wistar rats

*(n=6); *P < 0.05 compared with control group, $^{+}$P < 0.05 compared with alcohol only group (group 2)*

Histological studies of Liver

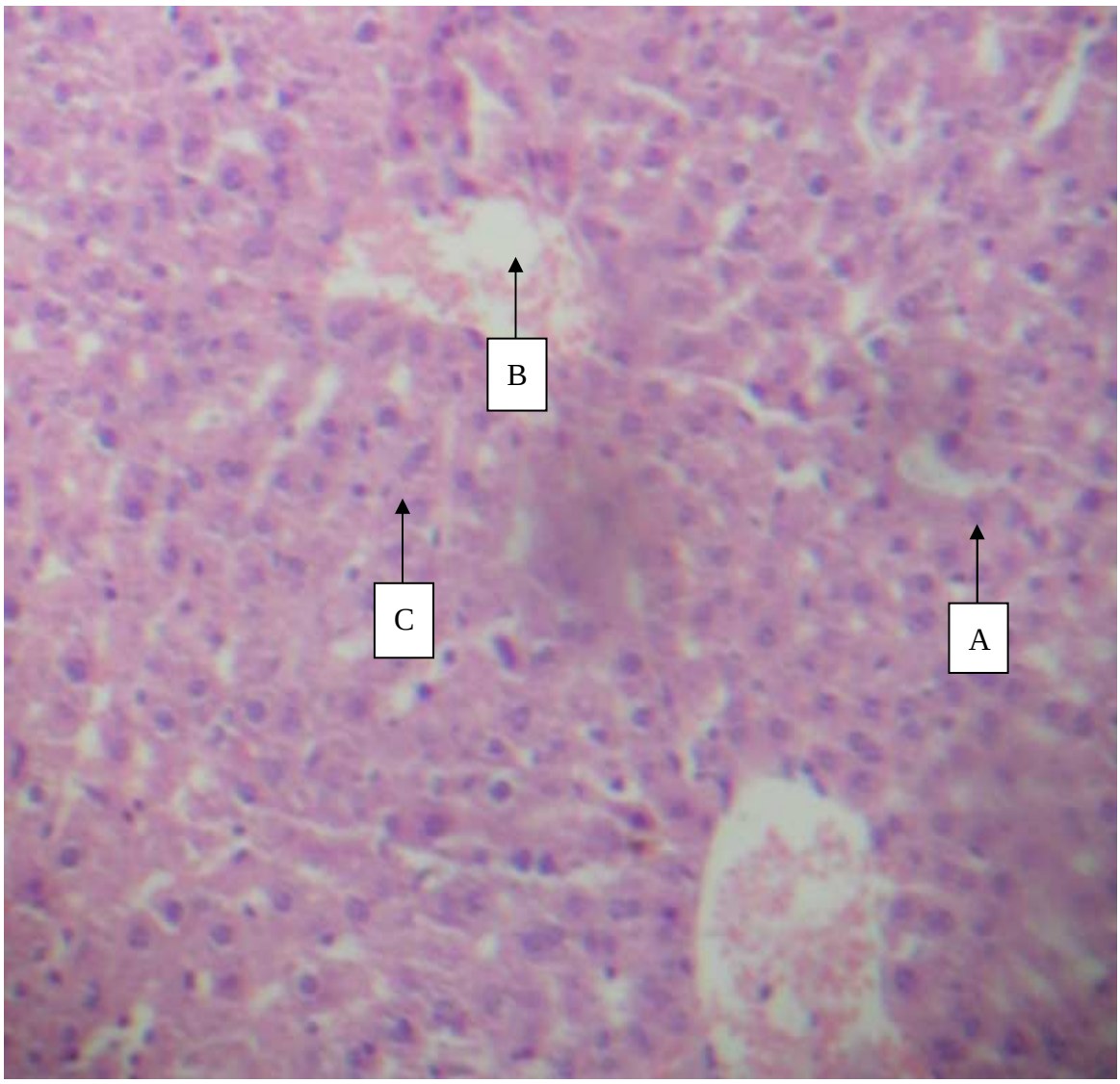

Fig 7: Group 1 (Control) showing normal Liver architecture, Central Vein A, Portal Triad B, and Hepatocytes C (H&E x 10)

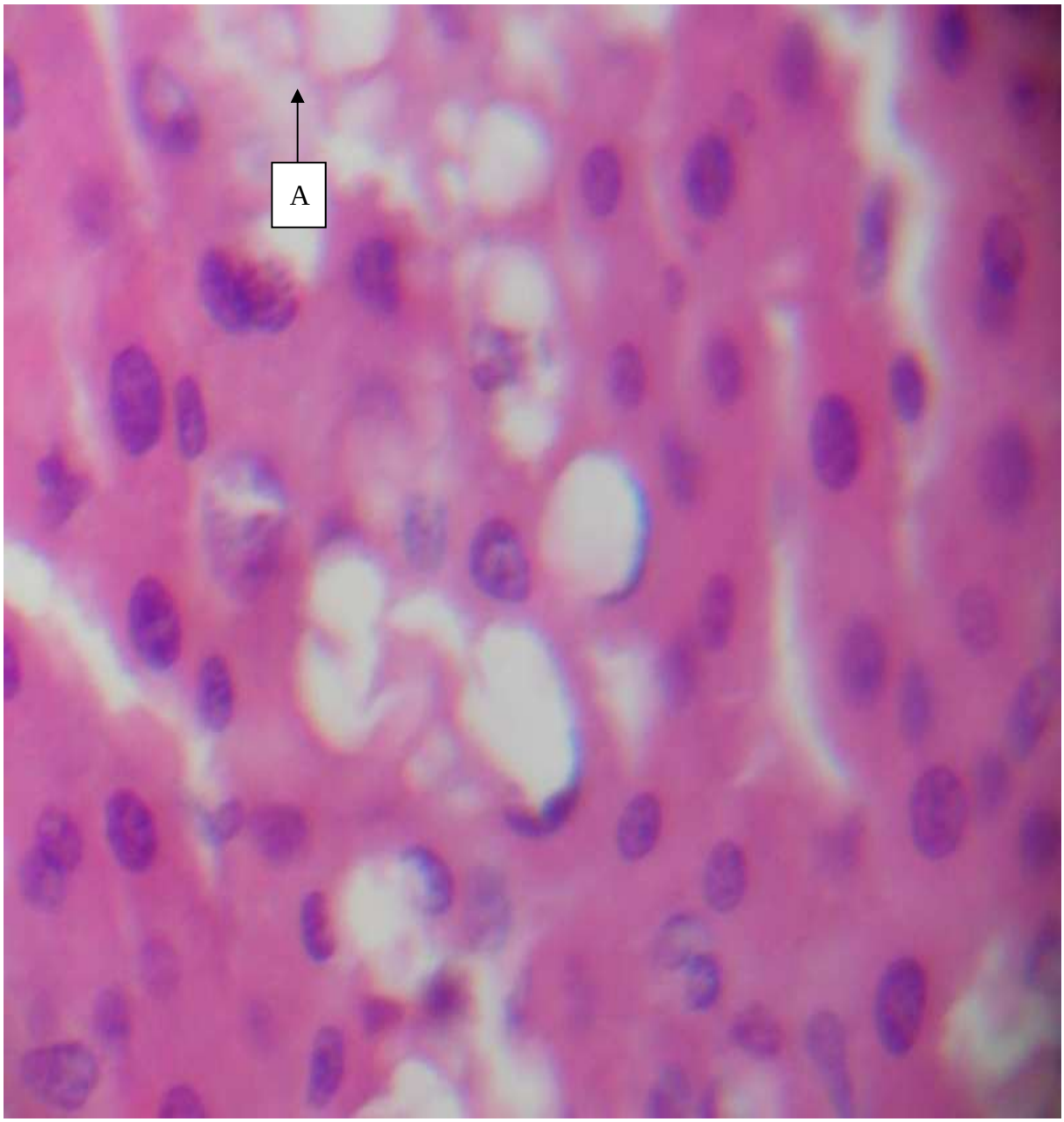

Fig 8 (Group 2) Alcohol treated only. Liver showing Moderate Fatty Liver with Congestion A (H&E x 10)

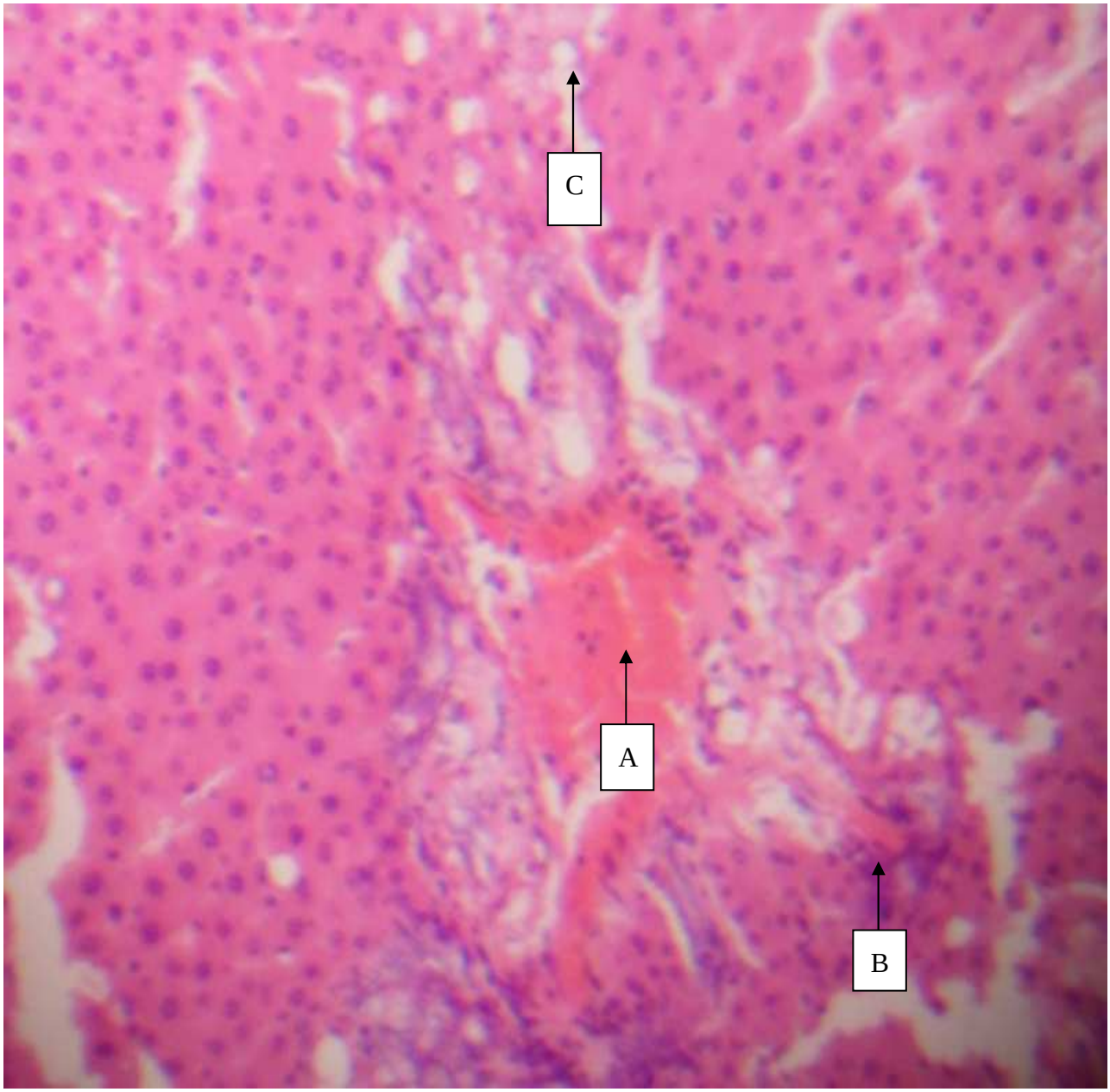

Fig 9: Group 3 Received alcohol + 1ml of *Cocos nucifera* water. Liver Showing Moderate Portal Congestion A, Mild Periportal infiltrates of Chronic inflammatory Cells B, and Mild Fatty Liver C (H&E x 10)

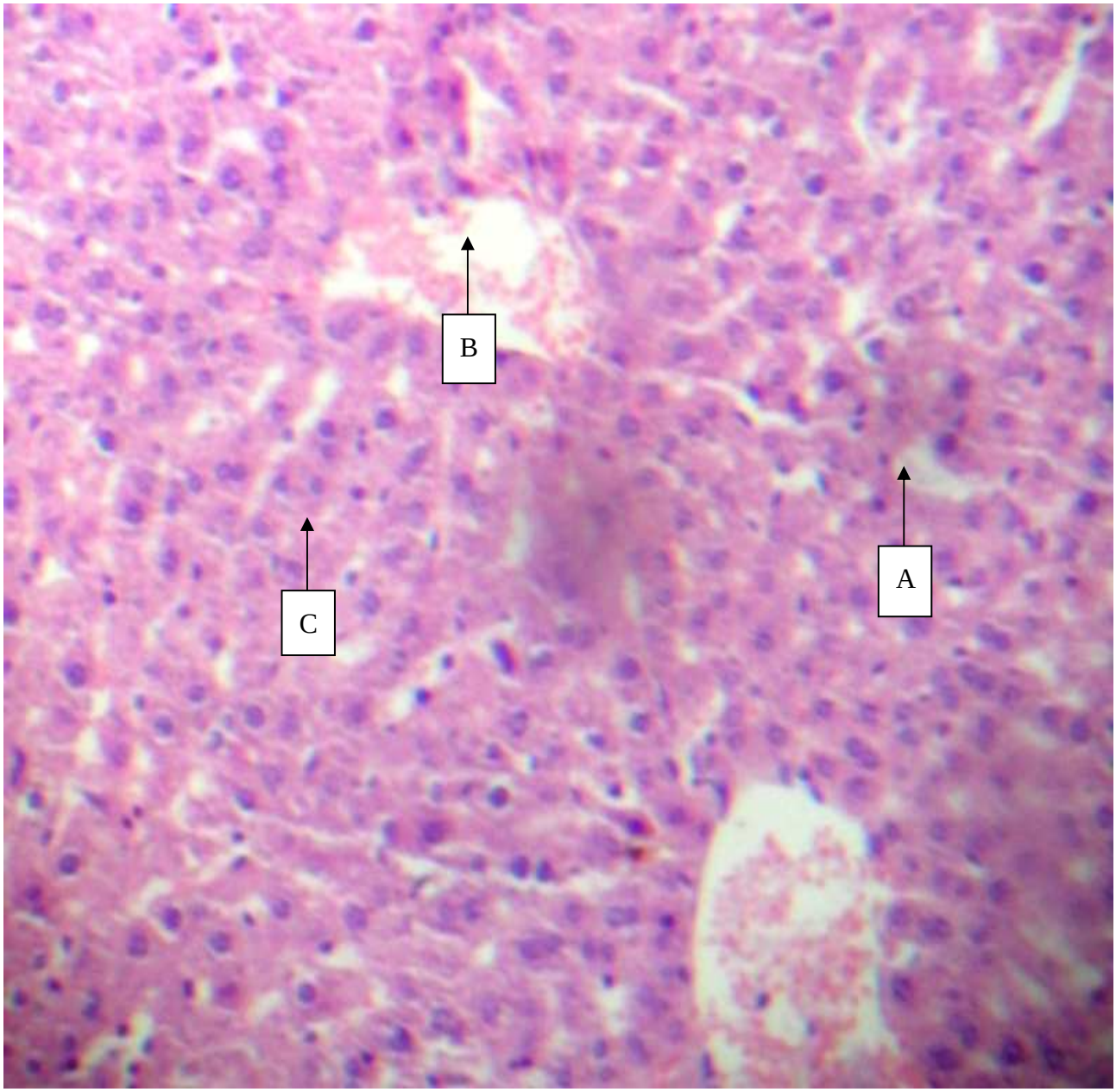

Fig 10: Group 4, Received alcohol and 2ml of *Cocos nucifera* water Liver Showing Central Vein A, Portal Triad B, and regenerating Hepatocytes C (H&E x 10)

4. Discussion

Most of the alcohol consumed by people is metabolised by the liver. Therefore, the liver is constantly saddled with the responsibility of detoxification of substances ingested. It is documented that a number of potentially dangerous by-products are generated (Maher, 1997) these by-products especially free radicals are known to cause destruction of the liver cell hence elevation of ALT, ALP, ALT and γ-GT. (Onyesom and Atakuo, 1998).

Alchohol may lead to hepatotoxicity; ALT, AST, ALP and γ-GT are most commonly used markers of hepatocyte injury. Whereas AST is non- specific, can be elevated after exercise, ALT is a

better maker as it is a sign of inflammation and/or injury to liver cells. Gamma Glutanyl transferase (γ-GT) is a sensitive marker of alcohol ingestion and certain hepatotoxic drugs. (Palmer 2004).

In the present study, following the treatment with alcohol, there is a significant ($P< 0.05$) elevation in ALT, AST, ALP and γ-GT (Group 2) which confirms the likely hepatotoxic effect of alcohol. This finding is in line with the report of Maher (1997). It was also observed that the concormittant administration of *Cocos nucifera* water showed a dose-dependent significant ($P< 0.05$) reduction in the liver enzyme makers in the group fed with 2mls of *Cocos nucifera* water. Also of note is the finding that administration of *Cocos nucifera* water at a dose of 2 ml (Group 4) and ad libitum (Group 5) did not show any significant difference with group 3 (1 ml).

Furthermore, the effect of the *Cocos nucifera* water on the histological studies of the liver showed infiltrations with cells of chronic inflammation and fatty liver as a result of alcohol (Fig 7) and a mild regenerative effect in the treatment group (Fig 8, 9, 10). This finding is consistent with a previous report by Nwangwa and Aloamaka (2011) on a similar effect on the pancreatic β-cells.

The phytochemical analysis of *Cocos nucifera* water showed that it contains a lot of antioxidants which help to scavenge the free radicals which is generally believed to be responsible for the damages. It is possible that the *Cocos nucifera* subserved its effect of improving the function of the liver via this pathway.

5. Conclusion

Coconut water is readily available, accessible and cheap, and the consumption of alcohol is on the increase. Further study is advocated in this area for its possible use as an alternative in the management of alcohol induced hepatotoxity.

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