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Research Article

Efficacy and Safety of Prednisolone in the Management of Alcohol-Induced Adverse Effects in a Rat Model

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ABSTRACT

Prednisolone is a corticosteroid drug that is widely prescribed for the treatment of various inflammatory conditions. The use of steroids in alcoholic liver disease (ALD) and other disorders associated with alcohol abuse remains controversial. Some studies have concluded that steroid therapy is beneficial in ALD patients, but other reports indicate a contrary opinion. The objective of this study was to examine the effect of treatment with prednisolone on early intervention of acute alcohol intoxication in a rat model. Experimental animals were divided into nine groups of five male Wistar rats which were treated as follows: distilled water; alcohol 7.5g/kg; alcohol 10g/kg; prednisolone 5mg/kg; prednisolone 9mg/kg; alcohol 7.5g/kg + prednisolone 5mg/kg; alcohol 7.5 g/kg + prednisolone 9mg/kg; alcohol 10g/kg + prednisolone 5mg/kg; and alcohol 10g/kg + prednisolone 9mg/kg. Alcohol was administered for five successive days in a week, while prednisolone was given for two consecutive days. All treatments were given orally once daily for a total of 4 weeks. Rats were then sacrificed and blood collected by cardiac puncture for haematological and biochemical assessment. Data collected were analysed using one-way ANOVA followed by Tukey's test. Alcohol reduced ($p < 0.05$) the red blood cells, haemoglobin, hematocrit, platelets, albumin, phosphorous, potassium, and sodium levels, while elevating ($p < 0.05$) lymphocyte, erythrocyte indices, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, gamma-glutamyltransferase, total bilirubin, urea, and creatinine values. Prednisone at 5 mg/kg was found effective in reversing leucocytosis. However, the drug was not useful in the management of other alcohol-induced disorders. Side effects attributed to prednisolone therapy involved macrocytosis, thrombocytopenia, elevated liver enzymes, hyperbilirubinemia, elevated kidney biomarkers, and electrolyte disturbance. The limited efficacy and low safety of prednisolone displayed in this study suggest that the drug is not useful in the early intervention of acute alcohol toxicity.

Keywords: Alcohol; Prednisolone; Liver; Rat

INTRODUCTION

The use of alcohol as an intoxicant has been in existence since prehistoric times [1]. Even though it is addictive, alcohol has proven to be socially acceptable and is widely used in many communities [2]. Light to moderate consumption of alcohol has some cardiovascular health benefits. However, its abuse is usually linked to organ damage and social problems [3].

Organs most affected by heavy and chronic drinking of alcohol are the liver and pancreas [4-6]. However, the drug is also known to induce a wide range of adverse effects on human reproduction, including fetal alcohol syndrome [7]. Alcohol is also linked to malnutrition, including protein, vitamin, and mineral deficiency [8]. For minerals, the most commonly observed electrolyte abnormalities are hypomagnesemia and hypocalcemia [9,10].

The harmful and toxic effects of alcohol on organs and tissues are mainly as a consequence of its oxidative breakdown to produce acetaldehyde, a direct hepatotoxin and a known carcinogen, and the associated formation of reactive oxygen species, depletion of co-factors like NAD+, and impairment of energy balance [6,11]. A number of factors affect an individual's vulnerability to the toxic effects of alcohol, including sex, environment, genetic predisposition, patterns of drinking, concomitant liver disease, and nutrition/lifestyle [6,12].

There are no approved therapies for alcoholic liver disease patients, and the current treatment regimens are for optimal disease management. Abstinence from alcohol consumption is considered the mainstay of treatment for patients with all stages of alcoholic liver disease. Cessation of alcohol consumption resolves alcoholic steatosis and also increases survival in patients with alcoholic cirrhosis [13].

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Almost all patients with severe alcoholic hepatitis and cirrhosis are malnourished [14-16]. Therefore, supplementation with micronutrients has to be considered if deficiencies are noticed. It has been shown that supplementation with a micronutrient such as zinc is very helpful in managing alcoholic liver injury [17]. For patients with end-stage liver disease, organ transplantation remains the last option, but post-transplant interventions are essential in helping patients uphold abstinence [18].

Some alcoholic liver disease patients have often turned to natural and herbal products based on their hepatoprotective potential. The most popular herbs are milk thistle seeds (silymarin), ginseng, green tea, ginkgo, and St. John's wort [19]. Other natural remedies that have reported effectiveness include betaine, curcumin, fenugreek seed polyphenol, vitamin E, and vitamin C [20], but the efficacy of these products is still a subject under deliberation.

Corticosteroids, mainly prednisolone, are also used for the management of alcoholic hepatitis. This is based on studies that have shown that corticosteroids improve liver function and inhibit proinflammatory cytokine and polymorphonuclear neutrophil activation [21-23]. This has been associated with their capacity to suppress the immune response and proinflammatory cytokine response, including IL-8 and TNF-α [24-26]. However, other studies have judged corticosteroids to be ineffective in improving overall or liver-related survival [27,28], therefore rationalizing further studies to decipher the anomaly.

The current study attempts to contribute to the issue by simultaneously investigating the impact of a high and low dose of corticosteroid therapy on acute alcohol toxicity using an animal model. The findings of this study may be of benefit in the management of liver diseases associated with alcoholism and other conditions.

MATERIALS AND METHODS

Materials

Alcohol (Ethyl alcohol 99.5%, Pharmco-Aaper, Brookfield, USA) was purchased from Kenya Laboratory Supply Centre (Nairobi, Kenya). Predsol® syrup (Borg Pharmaceutical Industries, Alexandria, Egypt) containing 1mg/ml prednisolone was sourced from a local pharmacy (Njimia Pharmaceuticals, Nairobi, Kenya).

Experimental animals

This study was carried out on male Wistar rats aged 8 to 10 weeks old, weighing between 110-180 gms. The rats were housed in cages in a well-ventilated room. They were fed on commercially available rodent pellets, and water was provided ad libitum during the study period. All procedures regarding animal treatment and experimentation were carried out in agreement with the International Society for Applied Ethology guidelines [29].

Table 1: Details of the treatment regimen.

Group	Treatment
A	Distilled water (control)
B	7.5 g/kg alcohol
C	10 g/kg alcohol
D	5 mg/kg prednisolone
E	9 mg/kg prednisolone
F	7.5 g/kg alcohol+5 mg/kg prednisolone
G	7.5 g/kg alcohol+9 mg/kg prednisolone
H	10 g/kg alcohol+5 mg/kg prednisolone
I	10 g/kg alcohol+9 mg/kg prednisolone

Experimental design

The rats were randomly divided into nine groups of five animals each. The control group received distilled water while the other eight groups were treated with either alcohol or prednisolone or both. Details of the treatment are presented in Table 1. Ethanol was administered to the animals once daily for five consecutive days from Monday to Friday, while prednisolone was given once daily for two consecutive days on Saturday and Sunday. All the treatments were administered via oral gavage [30] using a cannula for four weeks.

Sampling

On day 29 of the experiment, all animals were euthanized using diethyl ether, and blood was drawn via cardiac puncture for use in haematological analysis. Serum was processed for biochemical analysis.

Hematological analysis

Blood was collected in EDTA vials, and a full haemogram was carried out using an automated hematological analyzer (Mindray BC 6800, Shanchon Mindray Bio-Medical Electronica Co. Ltd. China) [31]. In this study, the Total White Blood Cell count (TWBC), Red Blood Cell count (RBC), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin Concentration (MCHC), Hemoglobin (HB), and Hematocrit (HCT) were determined.

Biochemical analysis

After collection, the uncoagulated blood was left to clot for 10 minutes at room temperature and then centrifuged at 3000 rpm for 5 minutes. Serum was then collected and then assayed using a biochemistry auto-analyzer (Shanchon Mindray Bio-MedicalElectronica Co. Ltd., China). The parameters analyzed were alanine aminotransferase (ALT), aspartate aminotransferase (AST),alkaline phosphatase (ALP), gamma-glutamyl transferase (γ-GT), urea, creatinine, phosphate, potassium, chloride, sodium, and total bilirubin. The level of albumin was also determined using the bromocresol green technique [32].

Data management and statistical analysis

Biochemical and hematological data were expressed as mean ± standard deviation. A statistical analysis tool (MINITAB 17) was used to perform one-way ANOVA to determine whether there were significant differences among the nine experimental groups of animals. This was followed by a Tukey's post hoc test for multiple comparisons between individual groups. Significant differences between the treatment groups were reported at $p< 0.05$.

RESULTS

Effect of alcohol and prednisolone treatments on hematological parameters

Table 2 shows the effect of alcohol and prednisolone on the hematological profile of rats. Alcohol treatment caused a significant dose-dependent increase ($p<0.05$) in the total white blood cell

Table 2: Comparison of hematological parameters of rats subjected to treatment regimens of alcohol and prednisolone.

Treatment	TWBC (10^9/L)	RBC (10^{12}/L)	MCH (pg)	MCHC (g/L)	MCV (fL)	HB (g/L)	HCT (L/L)	Platelets (10^9/L)
Control	6.52 ± 1.66	8.11 ± 0.61	20.44 ± 0.83	289.8 ± 9.09	52.02 ± 0.85	137.2 ± 9.07	0.51 ± 0.01	865.0 ± 12.61
Eth 7.5 g/kg	12.24 ± 1.40*	4.48 ± 0.50*	30.92 ± 0.81*	383.8 ± 5.45*	74.76 ± 2.38*	111.0 ± 6.12*	0.43 ± 0.02*	728.8 ± 13.57*
Eth 10 g/kg	13.10 ± 0.99*	4.44 ± 0.63*	34.20 ± 1.22*	401.8 ± 6.02*	78.24 ± 1.54*	95.8 ± 10.85*	0.37 ± 0.02*	623.2 ± 16.53*
Pred 5 mg/kg	4.96 ± 1.48	7.05 ± 0.46	24.00 ± 0.69*	309.2 ± 9.12*	66.52 ± 1.30*	123.2 ± 5.50	0.48 ± 0.01	818.4 ± 15.13*
Pred 9 mg/kg	14.48 ± 3.72*	5.52 ± 0.54*	23.32 ± 0.85*	220.8 ± 12.68*	64.84 ± 2.88*	122.4 ± 7.83*	0.45 ± 0.03*	783.8 ± 10.71*
Eth 7.5 g/kg + Pred 5 mg/kg	8.80 ± 1.16	5.11 ± 0.56*	25.94 ± 1.20*	330.0 ± 13.78*	69.04 ± 1.59*	112.6 ± 4.62*	0.40 ± 0.01*	775.8 ± 14.29
Eth 7.5 g/kg + Pred 9 mg/kg	12.76 ± 1.57*	5.58 ± 0.59*	24.78 ± 1.60*	344.4 ± 8.32*	71.98 ± 2.47*	111.8 ± 4.32*	0.41 ± 0.01*	766.0 ± 8.94*
Eth 10 g/kg + Pred 5 mg/kg	8.36 ± 1.08	5.64 ± 0.70*	27.00 ± 1.07*	359.2 ± 5.89*	73.06 ± 1.48*	102.0 ± 4.74*	0.35 ± 0.02*	671.8 ± 12.52*
Eth 10 g/kg + Pred 9 mg/kg	7.82 ± 1.58	4.69 ± 0.66*	30.08 ± 1.76*	379.2 ± 11.43*	74.50 ± 1.75*	97.40 ± 7.37*	0.39 ± 0.01*	656.6 ± 21.04*

The values are expressed as Mean ± SD for five animals per group. *p<0.05 when compared to the control group. TWBC=total white blood cells; RBC=red blood cells; MCH=mean corpuscular hemoglobin; MCHC=mean corpuscular hemoglobin concentration; MCV=mean corpuscular volume; HB=hemoglobin; HCT=hematocrit; Eth=ethanol; Pred=prednisolone.

Table 3: Comparison of biochemical parameters of rats subjected to treatment regimens of alcohol and prednisolone.

Treatment	ALT (U/L)	AST (U/L)	γ-GT (U/L)	ALP (U/L)	Albumin (g/L)	Total bilirubin (μmol/L)
Control	31.60 ± 5.05	45.92 ± 3.97	9.95 ± 4.61	78.36 ± 3.67	38.4 ± 2.51	7.42 ± 1.58
Eth 7.5 g/kg	155.44 ± 11.7*	160.10 ± 12.42*	40.00 ± 1.22*	120.60 ± 3.35*	30.8 ± 2.86*	9.85 ± 0.41*
Eth 10 g/kg	164.16 ± 9.75*	168.30 ± 9.76*	42.29 ± 3.05*	130.64 ± 4.39*	25.8 ± 2.28*	10.50 ± 0.46*
Pred 5 mg/kg	136.06 ± 5.57*	143.04 ± 13.51*	9.85 ± 1.11	116.56 ± 4.29*	34.6 ± 3.36	9.37 ± 0.25*
Pred 9 mg/kg	155.32 ± 7.67*	162.30 ± 8.44*	10.80 ± 1.97	114.82 ± 3.91*	36.2 ± 3.70	9.68 ± 0.26*
Eth 7.5 g/kg + Pred 5 mg/kg	144.86 ± 16.89*	147.92 ± 17.01*	40.24 ± 0.60*	117.96 ± 2.54*	29.2 ± 4.55*	9.68 ± 0.26*
Eth 7.5 g/kg + Pred 9 mg/kg	149.12 ± 7.58*	155.04 ± 5.66*	41.79 ± 2.05*	117.28 ± 3.70*	32.6 ± 4.04	10.02 ± 0.36*
Eth 10 g/kg + Pred 5mg/kg	149.68 ± 11.28*	157.58 ± 11.12*	26.82 ± 12.90*	112.98 ± 1.89*	29.0 ± 3.16*	9.99 ± 0.33*
Eth 10 g/kg + Pred 9mg/kg	150.78 ± 11.70*	157.42 ± 9.34*	33.51 ± 3.06*	114.08 ± 1.28*	31.0 ± 3.08*	10.33 ± 0.74*

The values are expressed as Mean ± SD for five animals per group: *p<0.05 when compared to the control group. ALT=alanine aminotransferase; AST=aspartate aminotransferase; γ-GT=gamma-glutamyl transferase; ALP=alkaline phosphatase; Eth=ethanol; Pred=prednisolone.

counts. For prednisolone, the 5 mg/kg dose had an insignificant (p>0.05) effect on the number of white blood cells. However, when the dosage was increased to 9 mg/kg, the counts were significantly (p<0.05) elevated. In the sub-groups that were treated with alcohol followed by prednisolone, the number of TWBC was similar (p>0.05) to that of the controls, except for the group that was co-treated with 7.5 g/kg alcohol and 9 mg/kg prednisone that showed a significant (p<0.05) elevation of the total leucocyte counts.

The effects of alcohol and prednisolone on the red blood cell counts and its related indices was that alcohol did significantly (p<0.05) reduce the erythrocyte, hemoglobin, and hematocrit values in rats, and the effect was dose-dependent. Prednisolone at 5 mg/kg had no effect (p>0.05) on the three indices, but when the dosage was increased to 9 mg/kg, the impact was similar to that of alcohol. For the animals treated with both alcohol and prednisolone, the RBC, HB, and HCT values were significantly (p<0.05) lower than the control group.

As for MCH, MCHC, and MCV indices, alcohol did significantly (p<0.05) increase the values in a dose-dependent manner (Table 2). Prednisolone at 5 mg/kg had a similar effect to that of alcohol. The 9 mg/kg dose of prednisolone caused elevation of MCH and MCV values and a reduction of MCHC (p<0.05). When the animals were co-treated with alcohol and prednisolone, the values of the three indices were significantly (p<0.05) higher than the control group. Likewise, when given separately or combined, alcohol and prednisolone caused a significant (p<0.05) reduction in the platelet counts across all treatment groups.

Effect of alcohol and prednisolone on biochemical parameters of rats

Liver function

Table 3 shows the effect of various treatments on the biomarkers of liver function. Alcohol caused a significant (p < 0.05) and dose-dependent elevation of ALT, AST, γ-GT, and ALP enzymes and the total bilirubin. Conversely, it led to a decrease in serum albumin levels. Prednisolone treatment showed an increase in ALT, AST, ALP, and total bilirubin levels, but had no significant effects on γ-GT and serum albumin levels.

Co-administration of alcohol and prednisolone resulted in significant (p<0.05) elevation of ALT, AST, γ-GT, ALP, and total bilirubin levels. Serum albumin levels were also elevated except in the group treated with 7.5 g/kg of alcohol and 9 mg/kg prednisolone.

Kidney function

For kidney biomarkers, alcohol and prednisolone, when given separately or combined, were found to significantly (p<0.05) increase the serum levels of urea and creatinine.

Electrolytes

When alcohol and prednisolone were administered individually or

Table 4: Comparison of serum electrolytes of rats subjected to treatment regimens of alcohol and prednisolone.

Treatment	Phosphorous (mmol/L)	Potassium (mmol/L)	Sodium (mmol/L)	Chloride (mmol/L)
Control	4.08 ± 0.28	8.16 ± 0.26	171.98 ± 5.80	106.12 ± 6.45
Eth 7.5 g/kg	2.72 ± 0.39*	6.81 ± 0.67*	154.52 ± 8.30*	100.52 ± 4.39
Eth 10 g/kg	2.84 ± 0.17*	7.06 ± 0.30*	159.00 ± 2.00*	103.78 ± 5.97
Pred 5 mg/kg	1.23 ± 0.18*	7.15 ± 0.60*	158.50 ± 2.07*	102.22 ± 5.91
Pred 9 mg/kg	1.65 ± 0.39*	7.46 ± 0.40*	159.36 ± 2.37*	103.54 ± 5.66
Eth 7.5 g/kg + Pred 5 mg/kg	2.17 ± 0.20*	6.80 ± 0.72*	161.46 ± 3.92*	103.06 ± 5.45
Eth 7.5 g/kg + Pred 9 mg/kg	2.76 ± 0.20*	7.10 ± 0.88*	163.45 ± 3.46*	104.38 ± 6.58
Eth 10 g/kg + Pred 5 mg/kg	1.52 ± 0.18*	6.23 ± 0.45*	159.36 ± 4.14*	103.16 ± 7.93
Eth 10 g/kg + Pred 9 mg/kg	3.53 ± 0.70*	6.54 ± 0.35*	159.40 ± 1.77*	104.74 ± 4.76

The values are expressed as Mean ± SD for five animals per group. *p<0.05 when compared to the control group. Eth=ethanol; Pred=prednisolone.

Table 5: Comparison of relative organ to body weight ratios of rats subjected to treatment regimens of alcohol and prednisolone.

Treatment	Percent relative organ to body weight		
	Liver	Kidney	Brain
Control	5.14 ± 0.84	0.96 ± 0.10	1.06 ± 0.11
Eth 7.5 g/kg	5.85 ± 0.75	0.99 ± 0.04	0.86 ± 0.05
Eth 10 g/kg	8.09 ± 1.51*	1.43 ± 0.18*	1.03 ± 0.09
Pred 5 mg/kg	5.59 ± 1.29	0.90 ± 0.21	0.88 ± 0.16
Pred 9 mg/kg	5.40 ± 0.65	0.95 ± 0.18	0.90 ± 0.23
Eth 7.5 g/kg + Pred 5 mg/kg	4.93 ± 0.92	0.93 ± 0.16	0.91 ± 0.07
Eth 7.5 g/kg + Pred 9 mg/kg	5.44 ± 0.92	0.96 ± 0.20	0.91 ± 0.28
Eth 10 g/kg + Pred 5 mg/kg	6.44 ± 0.40	1.12 ± 0.07	0.91 ± 0.08
Eth 10g/kg + Pred 9 mg/kg	6.04 ± 1.34	1.10 ± 0.20	0.96 ± 0.11

Results are expressed as Mean ± SD for five animals per group. *p<0.05 when compared to the control group. Eth=ethanol; Pred=prednisolone.

combined, there was a significant (p<0.05) reduction in the serum levels of phosphorous, potassium, and sodium (Table 4). However, chloride levels were unaffected (p>0.05) across all treatment groups.

Effect of treatments on the ratio of body weight to organ weight

Table 5 shows the effects of alcohol and prednisolone on the relative organ to body weight ratio of laboratory rats. Alcohol at 7.5 g/kg body weight did not significantly (p>0.05) alter the organ to body weight ratio of the liver, kidney, or brain. However, when administered at a higher dose of 10 g/kg body weight, alcohol showed a significant (p<0.05) increase in the organ to body weight ratio of liver and kidney relative to the control group. Nevertheless, there was no significant change in the organ to body weight ratio of the brain (p>0.05). Treatment with prednisolone, either separately or combined with alcohol treatment, did not significantly (p>0.05) alter the organ to body weight ratio of the three organs (Table 5).

DISCUSSION AND CONCLUSION

Administration of alcohol caused an increase in the proliferation (p<0.05) of the total white blood cells. Leucocytosis is associated with alcoholic hepatitis, and it directly correlates with the degree of hepatic inflammation [33]. Here, the biomarkers of liver function were significantly (p< 0.05) elevated following alcohol treatment, and this suggests that leucocytosis can be attributed to liver disease. Prednisolone treatment displayed mixed results with the low dose of the drug showing attenuation of leucocytosis but the high dose was ineffective. Studies have shown that corticosteroids are capable of decreasing leukocyte emigration [34], trafficking [35], as well as influencing their death or survival [36,37], thus shaping their subsequent response. Although leucocytosis plays a vital role in the destruction of invading pathogens, a marked increase in leukocyte counts is detrimental as it is associated with various disorders such as allergies and asthma [38]. The results from the present study show that a dose of 5 mg/kg of prednisolone therapy is beneficial in the management of leucocytosis, but a dose of 9 mg/kg is not.

Alcohol intake in rats resulted in a significant decrease in the total count of red blood cells and elevation of the mean corpuscular volume. This outcome correlates well with that of many studies that have linked alcohol consumption with the development of macrocytosis, which may or may not be associated with anaemia [39-41]. Das and Vasudevan [42] attributed the development of macrocytosis and anaemia in chronic alcoholism to the direct damaging effect of alcohol on the elytroid precursors in the bone marrow. The results from their study indicate that the mean corpuscular volume is a sensitive marker for the detection of excessive intake of alcohol, therefore supporting its use as part of the screening protocol for detecting the abuse of alcohol [40,43]. Prednisolone, on its own, was also able to significantly (p<0.05) reduce the red blood cell counts, thereby explaining why the drug was ineffective in reversing the alcohol-induced macrocytic anaemia.

Alcohol was shown to exhibit a significant (p< 0.05) increase in the serum levels of the liver enzymes, which is an indication of hepatocellular injury. These results on hepatocellular injury are consistent with those reported in previous studies [44-47]. Prednisolone administration was ineffective in normalizing the elevated liver enzymes in alcoholic rats, a finding that is in

agreement with a study by Kondratjeva and Brilgele [48], who reported increased activity of serum gamma-glutamyltransferase in dogs following prednisolone administration. Rebolledo and colleagues [49] also found similar results in that prednisolone treatment reduced circulating interleukin-6 and creatinine plasma levels but not serum AST, ALT, or LDH levels in brain-dead rats. The above results are contrary to those of other studies that have found prednisolone to be hepatoprotective by reducing the levels of elevated AST and ALT enzymes [50-52]. Disagreement in results between these studies could be attributed to factors such as the amount and duration of alcohol treatment, the dosage of prednisolone, and the experimental model employed.

Elevation of bilirubin and reduction of albumin levels by alcohol is a further testament of alcohol-induced hepatotoxicity. A possible mechanism for the increase in total bilirubin is that alcohol competitively inhibits bilirubin conjugation, leading to hyperbilirubinemia [53]. On the other hand, hypoalbuminemia may be attributed to cellular necrosis and the resultant problem in protein synthesis [54]. In the present study utilizing an experimental rat model, prednisolone was ineffective in influencing the alcohol-induced hyperbilirubinemia and hypoalbuminemia, which is a further indication of a lack of hepatoprotection by the drug.

Alcohol did significantly increase the serum levels of urea and creatinine. Elevation of these biomarkers indicates oxidative stress progressing to kidney injury [55,56]. Although the association between high alcohol consumption and kidney damage remains controversial [57-60], it has been recognized that chronic alcohol intake can affect renal function [61,62]. In the present study, the elevation of biomarkers for renal health is an indication of alcohol-induced renal injury. Hassan and colleagues [63] attributed kidney degeneration to the direct toxic effect of alcohol, which led to an increase in protein oxidation and acetaldehyde oxidation, resulting in an increase in reactive oxygen species.

Prednisolone therapy did not lower urea and creatinine values in the alcohol-treated animals, suggesting that the drug was ineffective in protecting against alcohol-induced kidney damage. In fact, when the drug was administered alone, it resulted in a significant elevation of serum levels of urea and creatinine. There is a scarcity of studies examining the direct influence of prednisolone on serum urea and creatinine. One study concluded that although prednisolone administration resulted in a rise in glomerular filtration that was not reflected by a decrease in serum urea and creatinine concentration [64]. The increase in serum urea and creatinine concentration was attributed to the catabolic effect of prednisolone.

Alcohol significantly reduced the plasma levels of sodium, potassium, and phosphorous, but chloride levels were unaffected. Various reports have shown that alcohol influences blood concentrations of key electrolytes and causes severe alterations in the body's acid-base balance [65-69]. Alcohol-induced mineral imbalance may result from insufficient dietary intake, impaired reabsorption, increased urinary loss, and disruption of the hormonal control mechanisms [69,70]. In the present work, electrolyte imbalance was likely caused by the impaired kidney. When administered alone, prednisolone also resulted in low levels of serum electrolytes. This finding is in agreement with the observation that patients treated with steroids have low blood levels of critical electrolytes [71-73]. Therefore, this study does not support the use of prednisolone in cases where the patient has electrolyte disturbance as it is likely to aggravate the condition.

Regarding the safety of prednisolone, the analysis of blood data indicates that the drug has a host of side effects that involved interference with the function of the bone marrow, mineral imbalance, and pathology on the liver and kidney. There is, therefore, a need to exercise caution when using prednisolone, as has been previously reported [74-76].

Alcohol caused leucocytosis, macrocytosis, anaemia, and thrombocytopenia. Prednisolone was ineffective in the management of macrocytic anaemia and thrombocytopenia. However, at 5 mg/kg, the drug was effective in containing leucocytosis.

In the liver, alcohol caused elevation of liver enzymes, hyperbilirubinemia, and hypoalbuminemia. For renal function, it caused elevation creatinine and urea, and depletion of phosphorous, potassium, and sodium levels. These changes were indicative of liver and kidney injury. Corticosteroid therapy was found not to be hepatoprotective and was not useful in alleviating renal pathology.

Side effects attributed to prednisolone therapy in managing alcohol toxicity included macrocytosis, thrombocytopenia, elevated liver enzymes, hyperbilirubinemia, elevated kidney biomarkers, and electrolyte disturbance.

CONFLICTS OF INTEREST

None to report.

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