Effect of Vasodilator (Apresoline) on Haematological and Biochemical Parameters in Male Wistar Rats

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Abstract

Objective: This study was designed to evaluate the effect of vasodilator on haematological and plasma biochemical parameters in male Wistar rats.

Methods: Twelve male rats (120 – 140 g) were divided into control (distilled water) and vasodilator-treated (0.36 mg/kg) groups (6 per group) for haematological and biochemical studies. The animals were orally treated on daily basis for 50 days. Red Blood Cell (RBC) counts and Total White Blood Cell (TWBC) counts were determined using haemocytometer. Activities of plasma Alanine Amino Transferase (ALT), Aspartate Amino Transferase (AST), Alkaline Phosphatase (ALP), as well as levels of total protein, globulin, albumin, creatinine and Blood Urea Nitrogen (BUN) were determined by spectrophotometry. Data were analysed using descriptive statistics and ANOVA at p=0.05.

Results: Treatment of rats with vasodilator (0.36 mg/kg) caused significant (p<0.05) increments in PCV, Hb, platelet and neutrophil values, while significant (p<0.05) reductions in lymphocyte and globulin values relative to their respective controls.

Conclusion: It can therefore be concluded that the vasodilator probably has beneficial and harmful effects on haematological and plasma biochemical functions in male rats.

Keywords: Vasodilator, Rats, Total white blood cell counts, Red blood cell counts, Total protein.

INTRODUCTION

Vasodilators are medications that dilate blood vessels. Vasodilators act directly on the smooth muscle of arteries to relax their walls so blood can move more easily through them; they are only used in hypertensive emergencies or when other drugs have failed, and even so are rarely given alone. Effects of vasodilators on coronary flow and simultaneous release of nitric oxide from guinea pig isolated hearts has been reported [1]. Hemodynamic effects of vasodilators and long-term response in heart failure has been reported [2]. Renal effects of vasodilators in acute heart failure [3] as well as their effects on isolated human uteroplacental arteries [4] have been reported. However, due to dearth of information from literature on the effect of vasodilator on haematological and biochemical parameters in male rats, this study therefore aims at investigating the effect of this antihypertensive agent on these aforementioned parameters in male rats.

MATERIALS AND METHODS

Experimental Animals

Adult male rats weighing between 120 g – 140 g bred in the Pre-Clinical Animal House of the College of Medicine and Health Sciences, Afe Babalola University were used. They were housed under standard laboratory conditions and had free access to feed and water; they were acclimatized for two weeks to laboratory conditions before the commencement of the experiments. All experiments were carried out in compliance with the recommendations of Afe Babalola University Ethics Committee on guiding principles on care and use of animals.

Drug

Vasodilator (apresoline) tablets (Norvatis Pharma Ltd) were bought from Danax Pharmacy, Ibadan, Nigeria. Vasodilator (25 mg) was dissolved in 10 ml of distilled water to give a concentration of 2.5 mg/ml. The dosage of vasodilator used in this study was in accordance with that reported by the manufacturer.

Experimental Design

Twelve male rats (120 – 140 g) were randomly divided into two groups, with each consisting of six animals. The two groups were subjected to the following oral treatments once a day for fifty (50) days:

Group I: received 0.5 mL/100 g of distilled water as control group.
Group II: received 0.36 mg/kg of vasodilator.

Collection of blood samples

Twenty four hours (day 51) after the last dosing of all the groups, blood samples were collected from all the animals through the medial canthus with heparinized capillary tubes into EDTA bottles for hematological and plasma biochemical analysis. Before assays, the blood was centrifuged for 5 minutes using a bench top centrifuge (Centromix) and the plasma were used for the determination of the biochemical parameters.

Determination of Haematological Parameters

The red blood cells (RBC) and white blood cells (WBC) counts were determined by the Improved Neubauer haemocytometer method. The packed cell volume (PCV) was determined by the micro-haematocrit method according to [6]. Schilling method of differential leukocyte count was used to determine the distribution of the various white blood cells [7]. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were computed according to [5].

Determination of Plasma Biochemical Parameters

The total protein concentration was determined using the Biuret method [8] and the albumin concentration by the method of [9]. The globulin concentration was calculated by subtracting the albumin concentration from the total protein concentration. Activities of plasma alanine transaminase (ALT) and aspartate transaminase (AST) were determined according to the method of [10]. The level of creatinine, urea and alkaline phosphatase were determined using the method of [11]. All the above biochemical parameters were determined in the plasma using the Randox kits.

Statistical Analysis

The mean and standard error of mean (S.E.M.) were calculated for all values. Comparison between the control and experimental groups was done using one-way analysis of variance (ANOVA) with Duncan’s Multiple Range Test. Differences were considered statistically significant at p<0.05.
RESULTS

The effect of vasodilator (0.36 mg/kg) on haematological and plasma biochemical parameters after treatment of rats for 50 days is shown in Tables 1 and 2 respectively.

Treatment of rats with vasodilator (0.36 mg/kg) produced no significant (p>0.05) changes in RBC, TWBC, monocyte, eosinophil, MCV, MCHC and MCH values relative to their respective controls.

Treatment of rats with vasodilator (0.36 mg/kg) caused significant (p<0.05) reduction in lymphocyte value relative to their respective controls.

Vasodilator caused significant reduction in lymphocyte value which probably indicates that the acquired immune response of the body has been compromised. Contrary result was reported by [16] in isolated ergostrol treated rats.

Vasodilator caused significant increase in the neutrophil count which probably indicates an enhancement in the ability of the body to attack and destroy invading bacteria, viruses and other injurious agents (phagocytosis). Similar result was reported [17] in Dendretta tripodetia extract treated rats.

Vasodilator caused no significant change in the monocyte value which probably indicates that it has no effect in the phagocytic function of the body [18]. Contrary result was reported by [19] in Saccharomyces cerevisiae extract fed hens.

Vasodilator caused no significant change in eosinophil value which could indicate that it has no effect on the anti-allergic and anti-parasitic infectious responses of the body. Contrary result was reported by [20] in Arcotis actoellodes extract treated rats and mice.

Vasodilator caused insignificant changes in the MCV and MCH values which probably indicate it has no effect on induction of macrocytic anaemia, since increased MCV and MCH values are known to be indicative of macrocytic anaemia [21]. Similar result was reported by [22] in Jatropha gossypifolia extract treated rats. The insignificant change in the MCHC value caused by linsopril probably indicates that it has no effect on induction of hereditary spherocytosis, since MCHC values are known to be elevated in hereditary spherocytosis. Similar result was reported by [22] in Jatropha gossypifolia extract treated rats.

The result of the plasma biochemical study has shown that treatment of rats with vasodilator caused insignificant changes in total protein level. This might indicate that the drug has no effect on the buffering capacity of the blood as well as having no effect on the acid-base equilibrium state of the animal. Since it has been reported that plasma proteins have been reported to be responsible for 15% of buffering capacity of blood [13] and that osmotic pressure caused by the plasma proteins (called colloid osmotic pressure) tends to cause fluid movement by osmosis. Contrary result was reported by [23] in Euphorbia heterophylia extract treated rats.

Vasodilator caused no significant changes in albumin level which probably indicates that it has no effect in the plasma levels of metals, ions, fatty acids, amino acids, bilirubin and enzymes; since it has been reported that albumin serves as a carrier for metals, ions, fatty acids, amino acids, bilirubin, enzymes and drugs [13]. Contrary result was reported by [24] in Enicostemma axillare extract treated rats.

Vasodilator caused significant reduction in globulin level which probably indicates that this drug has compromised both the natural and acquired immunity of the body against invading organisms, since it has been reported that globulins are principally responsible for the body’s both natural and acquired immunity against invading organisms [18]. Contrary result was reported by [25] in Portulaca oleracea extracts treated rats.

The insignificant change in the activity of AST caused by the drug could indicate it has no effect on induction of tissue necrosis, since it has been reported that elevation in the activity of AST can be associated with cell necrosis of many tissues, which allows leakage of large amounts of this enzyme into the blood [26]. Contrary result was reported by [27] in Sida rhombifolia extract treated mice and rats.

Vasodilator caused an insignificant change in the activity of ALT which probably indicates that it has no effect on induction of hepatic damage, since it has been reported that ALT is present in the liver and other cells and is particularly useful in measuring hepatic necrosis, especially in small animals [28]. Contrary result was reported by [29] in Moringa oleifera extract treated rats.

Vasodilator caused no significant change in ALP level. This probably indicates the absence of cholestasis, since ALP has been elevated in the presence of hepatic necrosis or cholestasis [16]. Therefore, the result of the present study indicates that the drug has no effect on hepatic necrosis or cholestasis.

DISCUSSION

The result of the haematological study has shown that vasodilator caused significant increments in the PCV and Hb values. This could indicate that there were increments in the oxygen carrying capacity of the blood and the amount of oxygen delivered to the tissues, since RBC and haemoglobin (Hb) are very important in transferring respiratory gases [12]. Vasodilator caused no significant change in TWBC value which probably indicates that it has no effect on the ability of the body to defend against invading organisms [13]. Contrary result was reported by [14] in Viscum album extract treated rats.

Vasodilator caused significant increase in the platelet value which probably indicates an enhancement in the haemostatic function of the body. Similar result was reported by [15] in Fadogia agrestis extract treated rats.
reported to be a marker of cholestasis [30]. Similar result was reported by [22] in *Jatropha gossypifolia* extract treated rats. The vasodilator induced insignificant change in urea and creatinine levels. This probably indicates absence of nephrotoxicism (renal impairment), since urea and creatinine have been reported to be markers of kidney functions [31]. Contrary result was reported by [32] in *Passiflora edulis* extract treated rats.

**CONCLUSION**

In conclusion, this study has shown that the vasodilator has beneficial and harmful effects on the haematological and plasma biochemical functions in male rats. However, the effect of this antihypertensive agent on human haematological function and blood chemistry are unknown; nevertheless, considering these findings in animal model, it is recommended that patients should strictly comply with the dosage regimen as recommended by their physicians.

**CONFLICT OF INTEREST**

We vehemently declare that there is no conflict of interests in this research work.

**REFERENCES**