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Evaluation of biochemical and hematological effect of *Jatropha gossypiifolia* Linn. aqueous extract on albino rats

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Abstract

Jatropha gossypiifolia Linn. is a small shrub widely utilized in the treatment of various diseases and ailments. In spite of its therapeutic importance, there is paucity of information on the biochemical and hematological effect of aqueous extract of this plant on albino rats. This study aims to evaluate the effect of aqueous extract of the leaves of *Jatropha gossypiifolia* on biochemical markers of kidney and liver functions. Thirty males Wistar albino rats were randomly assigned into six groups. Group I (the control) was dosed with distilled water, while groups II, III, IV, V, and VI were treated orally with (100, 200, 400, 800, and 1600 mg/kg) of *J. gossypiifolia* aqueous extract respectively for 2 weeks. The rats were sacrificed about 24 hours after last exposure, and some biochemical and hematological parameters were evaluated. The results of biochemical parameters showed a significant dose-dependent increase in ALP and ALT values. Individual variations were observed in the levels of AST and TP values among the treatment groups. Hematological parameters result showed a significant dose-dependent increase in PCV and HG values. Individual variations were observed in the levels of WBC and RBC values among the treatment groups. The observed dose-dependent increase in levels of the serum enzymes might be due to negative interaction of the extract with the organ-system of the rats resulting in elevation of the levels of these enzymes. The study showed that although the plant extract does not exhibit acute toxicity, it is still not totally safe for human consumption.

Keywords: *Jatropha gossypiifolia*; Hematological parameters; Biochemical parameters; Liver function; Wistar rats

1. Introduction

Plant and animal products are utilized for medicinal purposes in alternative medicine. This practice dates back to prehistorical times across all continents. The knowledge of the curative or medicinal properties of these plants has been added down across generations within and across different communities [1]. Practice of alternative medicine is still widespread in developing countries where they are utilized to promote human health and cure certain types of diseases [2]. In recent times, the use of these herbal materials or nutraceuticals has continued to expand across the globe with a vast majority of people adopting them in healthcare treatment. In fact, patronage of these herbal drugs has expanded so much that many of them are now available in drugs store, supermarket and food stores [3]. The increase in patronage of herbal materials or therapy is due to various reasons, some of which includes the belief that it promotes healthier living as well as the high cost and side effects of many modern drugs [4]. These herbal materials are generally believed to be very safe and are usually introduced into the market without toxicity or safety evaluation, purchased without prescription and sometimes consumed indiscriminately [5]. In spite of their potential therapeutic advantages, herbal drugs have been reported to be capable of eliciting adverse reactions and producing mutagenic, teratogenic, carcinogenic and other potential toxic effects [6].

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Jatropha gossypiifolia Linn. is a small shrub belonging to family Euphorbiaceae. Different parts of this plant have been reported to possess medicinal properties and are subsequently utilized in the treatment of various diseases and ailments [7]. The leaves, stem and roots have been reported to possess widespread activities such as cytotoxic, antitumor, as well as antimalarial, antimicrobial, and insecticidal activities [8]. This study strives to evaluate the biochemical and hematological effect of aqueous extract of leaves of *J. gossypiifolia* on albino rats due to the paucity of published information in this field.

2. Material and methods

2.1. Collection and identification of plant materials

Fresh, mature healthy leaves of *J. gossypiifolia* were collected from Ile-Oluji town, Ondo State, Nigeria. The leaves were identified and authenticated at the herbarium within the Department of Botany, Federal University of Technology Akure, Nigeria.

2.2. Preparation of plant extract

Fresh leaves of *J. gossypiifolia* were washed with water, air-dried for 2 weeks and pulverized. A decoction of the leaves was prepared by boiling 300 g of the pulverized plant material in 1.5L of tap water for 30min. The extract was then filtered with Whatman No 1 filter paper and the filtrate was evaporated in vacuum (40 ^{o}C) using a rotary evaporator to obtain a yield of 20.5g. The concentrated gelatinous material obtained was then freeze-dried and reconstituted separately with distilled water to produce the required doses of 10, 200, 400, 800 and 1600 mg of extract per /kg body weight of the rats. The remaining residue was kept at −20°C for future use.

2.3. Animals

Thirty (30) disease-free male adult Wister albino rats weighing between 160-190 g were utilized for this study. The animals were obtained from the animal breeding unit of the Department of Science Laboratory Technology, Federal Polytechnic Ile-Oluji, Ondo State, Nigeria. The animals were housed in metal cages and fed on standard pellet *ad libitum* with free access to clean water and housed at constant temperatures of 21+ 2 °C, humidity (55 + 10 %) with a 12-h light, 12-h dark cycle. The rats were acclimatized to the laboratory environment for one week prior to commencement of the study. The study was ethically approved before the commencement of the study.

2.4. Sub-acute toxicity studies

The rats were divided into six groups of five animals each. Group I served as the control and were dosed with distilled water (vehicle), while groups II, III, IV, V, and VI were treated orally with (100, 200, 400, 800, and 1600 mg/kg) of *J. gossypiifolia* aqueous extract respectively for 2 weeks. Immediately after extract administration, the animals were placed under observation for 2 h to check for behavioral or neurological changes. About 24 hours after the last administration, the rats were anaesthetized, and 5 mL of blood were collected from each animal.

2.4.1. Serum preparation

About 1 mL of the collected blood was mixed with potassium EDTA and used for hematological studies. The remaining 4 mL of blood was allowed to clot, centrifuged at 3000 rpm for 10 minutes, and the supernatant (serum) was collected and transferred into labeled sample bottles. This serum was utilized to evaluate the biochemical parameters and the remaining serum was kept at −20 °C for future use.

2.4.2. Determination of hematological parameters

Hematological parameters evaluated include hemoglobin level (HGL), packed cell volume (PCV), red blood cell (RBC) count, and white blood cell (WBC) count. These parameters were determined using the URIT-2900 Automated Hematology Analyzer.

2.4.3. Determination of biochemical parameters

Biochemical parameters assayed include albumin and bilirubin levels as described by Gornal *et al.*, [9], alkaline phosphatase (ALP) as described by Englehardt *et al.*, [10], aspartate amino transferase (AST) and alanine amino transferase (ALT) as described by Rietman and Frankel [11]. These parameters were evaluated colorimetrically using standard commercially available ready-to-use Randox kits.

2.5. Statistical Analysis

The data obtained were expressed as means ± SD of three replicates. Statistical analysis was performed using SPSS (version 20). Groups were compared using Duncan multiple range test. Statistical significance was assumed at $p < 0.05$.

3. Results

3.1. Biochemical parameters

The effect of *J. gossypiifolia* aqueous extract on the biochemical parameters of exposed rats is presented in Table 1. The result showed a significant dose-dependent increase in ALP and ALT values among the treatment groups compared to the control. Individual variations were observed in the levels of AST and TP values among the treatment groups compared to the control. Significant reductions in serum AST and TP levels were observed at mid-dosage level, mainly 400 mg/kg for AST and TP. Generally, biochemical parameters were significantly higher in the control group than in the treatment groups.

3.2. Hematological parameters

The effect of *J. gossypiifolia* aqueous extract on the hematological parameters of exposed rats is presented in Table 2. The result showed a significant dose-dependent increase in PCV and HG values among the treatment groups compared to the control. Individual variations were observed in the levels of WBC and RBC values among the treatment groups compared to the control. Significant reductions in serum WBC and RBC levels were observed at high dosage levels, mainly 800 mg/kg for WBC and 400 mg/kg for RBC.

Table 1 Effect of *J. gossypiifolia* leaf extract on biochemical parameters of control and experimental groups

Group		ALP (U/L)	AST (U/L)	ALT (U/L)	TP (g/L)
I	Control	55.43^{a}	24.40^{a}	13.37^{a}	7.77^{a}
II	Extract (100 mg/kg)	47.17^{d}	21.13^{e}	8.80^{e}	4.50^{d}
III	Extract (200 mg/kg)	47.60^{d}	22.57^{cd}	9.33^{e}	5.37^{c}
IV	Extract (400 mg/kg)	49.50^{c}	21.87^{de}	10.33^{d}	5.30^{cd}
V	Extract (800 mg/kg)	53.07^{b}	23.37^{bc}	11.27^{c}	5.77^{c}
VI	Extract (1600 mg/kg)	53.43^{b}	23.87^{ab}	12.43^{b}	6.67^{b}
	Mean	51.03	22.87	10.92	5.89
	CV (%)	1.38	2.40	3.75	7.21
	SEM±	0.41	0.32	0.24	0.24
	F test	**	**	**	**
	LSD 0.05	1.25	0.98	0.73	0.76
	LSD 0.01	1.76	1.37	1.02	1.06

Values are expressed as Mean ± SEM (n = 3). Values not sharing a common superscript letter differ significantly at P<0.05 (DMRT). ALP = Alkaline Phosphatase; AST = Aspartate amino transferase; ALT = Alanine amino transferase; and TP = Total protein.

Table 2 Effect of *J. gossypiifolia* leaf extract on hematological parameters of control and experimental groups

Group		PCV (%)	WBC (X10³/mm³)	HG (g/dL)	RBC (× 10⁶/µL)
I	Control	31.0^{f}	6.71^{e}	9.10^{e}	6.23^{e}
II	Extract (100 mg/kg)	34.0^{e}	7.19^{e}	10.43^{d}	6.67^{d}
III	Extract (200 mg/kg)	37.70^{d}	8.25^{d}	11.57^{c}	8.40^{b}
IV	Extract (400 mg/kg)	41.53^{c}	10.90^{b}	13.33^{b}	7.33^{c}
V	Extract (800 mg/kg)	45.27^{b}	9.93^{c}	13.50^{b}	8.60^{b}
VI	Extract (1600 mg/kg)	47.53^{a}	12.03^{a}	15.13^{a}	8.93^{a}
	Mean	39.51	9.17	12.18	7.69
	CV (%)	1.93	4.24	3.23	2.21
	SEM±	0.44	0.22	0.23	9.81
	F test	**	**	**	**
	LSD 0.05	1.35	0.69	0.70	0.30
	LSD 0.01	1.90	0.97	0.98	0.42

Values are expressed as Mean ± SEM (n = 3). Values not sharing a common superscript letter differ significantly at P<0.05 (DMRT). PCV = packed cell volume; WBC = White blood cell; HG = Hemoglobin; and RBC = Red blood cell.

4. Discussion

Humans and model/ experimental animals are biologically similar and show similar response to some drugs. Ingested drugs are detoxified or metabolized in the liver; hence it is highly vulnerable to damage. The levels of certain enzymes present in the serum are indicative of the health of the liver. This is because damage to body tissues results in the release of these enzymes (especially AST and ALT) into the blood stream thereby raising the serum enzyme level. Elevated ALP level is indicative of injury or damage to the liver, bone disorders or bile duct obstruction. In fact, the more the damage, the higher the levels of these enzymes in the serum. The study showed that although the plant extract does not exhibit acute toxicity, it is still not totally safe for consumption. The observed dose-dependent increase in levels of the serum enzymes might be due to negative interaction of the extract with the organ-system of the rats resulting in elevation of the levels of these enzymes. In spite of the slight elevation, it was observed that almost all the serum biochemical and hematological values were normal and within the reference range for rats [12]. The result is similar to the elevated biochemical values obtained by Akinloye *et al.* [13]., in rats exposed to ethanolic extracts of *J. gossypiifolia,* compared to the control.

5. Conclusion

This study has shown that aqueous extract of leaves of *J. gossypiifolia* is not totally safe for consumption due to the alteration of biochemical and hematological parameters observed in albino rats in this study. Hence, it should only be consumed at moderate dosage level.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The experiment was performed in compliance with the United States National Institute of Health (NIH) publication "Guide for the Care and Use of Laboratory Animals" Eight Edition. National Academies Press, Washington DC. (2011).

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