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Antidiabetes, antidyslipidemia, hemoprotective, nehproprotective and hepatoprotective effect of ethanol extract of *Jatropha tanjorensis* leaf against alloxan induced diabetes in rats

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ABSTRACT

Background & Aim: Management/ treatment of illness and maintenance of well-being using herbal medicines is the oldest and most popular form of healthcare practice known to humankind that has been practiced by all cultures in all ages throughout the history of evolution. The ethanol extract of *Jatropha tanjorensis* leave was evaluated for it pharmacological potency in alloxan-induced diabetes in albino rats.

Experimental: Twenty-four adult male albino rats weighing 120-180g were randomly divided into six groups of four rats per group. Group I (Normal control) were given 0.2 mL of water. Group II (Negative control): were untreated diabetic rats. Group III were Diabetic rats treated with reference drug (glibenclamide at 5 mg/kg b.wt) which served as positive control. Group IV – VI were Diabetic rats treated with *Jatropha tanjorensis* leaf extract at a dose of 200 mg/kg b.wt, 400 mg/kg b.wt, and 600 mg/kg b.wt, respectively. Administrations were done orally for 14 days. Blood was collected from the tail of the rats to determine the blood glucose level on the 4th, 9th and 14th day of the study.

Results: The extract significantly reduced the blood glucose level. The *Jatropha tanjorensis* leaf extract showed dose dependent significant ($P<0.05$) decrease in the triacylglycerol (TAG), low density lipoprotein (LDL), Cholesterol, total white blood cell (TWBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT), bilirubin, urea, creatinine level as well as significant ($P<0.05$) increase in hemoglobin (Hb), packed cell volume (PCV), red blood cell (RBC) and albumin level when compared with diabetic untreated group (negative control). Diabetic-related alteration in rat serum biochemical indices were significantly improved by the extract.

Recommended applications/industries: The outcome of the research gave credence to the folk use *Jatropha tanjorensis* leaf in the treatment of diabetes and its health related dysfunctions.

1. Introduction

Treatment of illness and maintenance of health/well-being using herbal medicines is the oldest and most popular form of healthcare practice known to humanity that has been practiced by all cultures in all ages throughout the history of civilization (Paul *et al.*, 2015).

Herbal medicines involve the integration of several therapeutic experiences and practices of indigenous systems of medicine that may span many previous generations, which often provide valuable guidelines to the selection, preparation and application of herbal formulation with a view to providing therapeutic benefits. Medicinal plants have been used since ancient times for the treatment and management of diabetic mellitus (DM) in traditional medicine systems of many cultures throughout the world (Gurib-Fakim, 2006).

Diabetes Mellitus (DM) is debilitating metabolic disorder associated with carbohydrate metabolism and is a major cause of disability and hospitalization (Whiting *et al.*, 2011; Xie *et al.*, 2011; Eckel *et al.*, 2005). A section of Non-Insulin Dependent Diabetes Mellitus (NIDDM) patients can be managed by diet; others require oral hypoglycemic therapy and or insulin (Kodak-Kimble *et al*., 2005). Currently available pharmaceutical options for diabetes, like oral hypoglycemic agents and insulin, have serious limitations (Saxena and Vikram, 2004), hence the search for more effective anti-diabetic agents medicinal plants such as *Jatropha tanjorensis* have been recommended (Mukherjee *et al*., 2006).

Jatropha tanjorensis is a member of the "Euphorbiacea" family. It is popularly referred to as "Hospital Too Far", catholic vegetable, 'Iyana-Ipaja' or 'lapalapa' by the local folks in different parts of Nigeria (Iwalewa *et al.*, 2005).

Different parts of *Jatropha* plants are used in many ways and in different countries. The leaves of *J. tanjorensis*are locally consumed as vegetable (Orhue *et al.*, 2008; Iwalewa *et al.*, 2005). The leaves also serve medicinal purposes as they are used for the treatment of fevers, cabuncles, eczema, itches, sores on the tongues of babies, stomach acheand venereal diseases (Oduola, 2005). In the southern parts of Nigeria, the leaves of *J. tanjorensis* are used for the treatment of diabetes mellitus (Olayiwola *et al.*, 2004). It is also popular as a natural remedy against malarial infection and hypertension in some parts of Nigeria (Iwalewa *et al.*, 2005).

The undesirable side effects and high cost of anti-diabetic drugs led to the search for medicinal plants that exhibit hypoglycemic property, with a view to applying them for the management of Diabetes Mellitus (Paul *et al.*, 2015). Hence this study aimed at determining the antidiabetic and antidyslipidemic, hematological, nephroprotective and hepatoprotective effect of ethanol extract of *Jatropha tanjorensis* leaf on alloxan-induced diabetes in rats.

2. Materials and Methods

2.1. Reagents and chemicals

The alloxan monohydrate used in this study was a product of Oxford Laboratories Reagent, London. Finetest Blood Gluco-Strips was a product of Infopia Co., Ltd, Kyunggi-Do, Korea. HDL, Total Glycerides and Total Cholesterol kits were products of Randox Diagnostics, Crumlin, UK. Glibenclamide tablets were produced by Noble Pharmacy Nigeria Ltd, Nigeria.

2.2. Collection and identification of leaf sample

The leaves were harvested in the month of September 2018 from the vicinity of a home garden in Area N World Bank Owerri Imo State. The leaf was taxonomically in the Department of Plant Science and Biotechnology, Michael Okpara University of Agriculture, Umudike and Voucher specimen's number were deposited (MOUAU/PSB/BCH/0248) and kept at the Departmental herbarium. The leaves were washed and air dried for seven days and then pulverized into fine powder using pulverize machine (5126 TP), after which it was preserved in a container until when used.

2.3. Preparation of leaf extract

Pulverized (250g) was weighed and extraction was made exhaustively in 99% ethanol for 72 hours by maceration. The soaked sample was filtered with the aid of a clean Whatman No 1 filter paper to obtain a clear filtrate. The filtrate was subsequently evaporated to dryness (45 ± 2°C) using a rotary evaporator.

2.4. Determination of acute toxicity (LD50)

The median lethal dose (LD_{50}) of the ethanol leaf extract of *Jatropha tanjorensis* was determined by the method of Lorke (1983). Six groups of three adult albino-mice each weighing between 18-25 g were used for this study.

2.5. Preliminary phytochemical screening

Preliminary phytochemical test of flavonoids, tannins, Saponin, alkaloids, cardiac glycoside, steroid and phenols in the extracts were determined by the method described by Harborne and used by Unegbu *et al.* (2017).

2.6. Experimental animals

Male albino rats weighing 120-180 g were obtained from Michael Okpara University of Agriculture farms, Umudike, Abia state. The animals were housed in the Animal House of Pharmaceutical Technology, Federal Polytechnic Nekede at standard environmental condition and maintained under controlled room temperature with about 12 h light and 12 h dark cycle. Standard pellets obtained from Evans Ltd, Owerri, Imo State, Nigeria, were use as basal feed during the experimental period. The rats were acclimatized and handling of animals was consistent with guidelines given by NRC (2011) and the protocol was approved by Animal use Ethical Committee of Michael Okpara University of Agriculture Umudike with Ethical number BCM/EC/02/072.

2.7. Experimental design

Diabetes was induced by intra-peritoneal injection of alloxan at the concentration of 140 mg/kg. The rats that exhibited blood glucose levels to be above 200 mg/dL were regarded as successfully induced diabetes; and were used to further the experiment. Furthermore, the rats were assigned into six groups of four animals per group. The rats were grouped as follow:

- Group I (Normal control): Non-diabetic, non-treated rats; they were given 0.2 mL of water.
- Group II (Negative control): Diabetic, non-treated rats; they were induced for experimental diabetes but received 0.2 mL of water.
- Group III (Positive control): Diabetic, treated with reference drug glibenclamide at 5 mg/ kg b.wt.
- Group IV: Diabetic, treated with *Jatropha tanjorensis* leaf extract at a dose of 200 mg/kg b.wt of extract.
- Group V: Diabetic, treated with *Jatropha tanjorensis* leaf extract at a dose of 400 mg/kg b.wt of extract.
- Group VI: Diabetic, treated with *Jatropha tanjorensis* leaf extract at a dose of 600 mg/kg b.wt of extract. Administrations were done orally for 14 days. The blood glucose level of the rats were checked using accu chek glucometer on the 4th, 9th and 14th day.

2.8. Blood sample collection

After the experiment, the rats were sacrificed and the blood was collected through cardiac puncture into plain sample bottles for biochemical assay of lipid profile, liver and renal functions. The blood was centrifuged at 4000 g for 5 min (Anke TDL-5000B, Shanghai, China) and the serum aspirated by Pasteur pipette. The blood for hematological analysis was put into EDTA bottle.

2.9. Biochemical assay

Alanine aminotransferase and aspartate aminotransferase (ALT and AST) were determined by method of Reitman and Frankel (1957). ALP was determined by the phenolphthalein monophosphate method (Babson, 1965). Bilirubin was estimated by colorimetric method of Malloy and Evelyn (1937). Albumin test kit produced by Biosystem kits were used to estimate albumin. Serum Urea and serum creatinine were estimated by a method described by Fawcett and Scott (1960).

2.10. Determination of lipid profile

The total cholesterol, triglyceride, High Density Lipoprotein Cholesterol (HDL-C) and Low Density Lipoprotein Cholesterol (LDL-C) were measured using commercial reagent assay kits (Randox Diagnostics, Crumlin, UK).

2.11. Determination of haematological parameters

The assay for red blood cells (RBC) and white blood cells (WBC) counts were done using Neubauerhaemocytometer method with slight modification. The haemoglobin (Hb) concentration was determined according to Jain (1986) using the cyanomethaemoglobin method. The packed cell volume (PCV) was assayed using micro-haematocrit method as described by Dacie and Lewis (1991).

2.12. Statistical analysis

The results obtained were expressed as mean ± SD. The data were analyzed statistically by using One-way ANOVA of SPSS software version 20. The means were compared with Duncan's multiple range test. Significant difference was accepted at 95 % confidence level ($P<0.05$) and results were presented as mean ± standard deviation ($n = 4$).

3. Results and discussion

3.1. Acute oral toxicity (LD_{50}) of Jatropha tanjorensis leaf

In accordance to lorke's method for the evaluation of acute oral toxicity, the *Jatropha tanjorensis* leaf showed no acute toxicity because there was no death recorded up to the 5000 mg/kg b.w hence acute toxicity could not be determined as seen in Table 1. Therefore LD_{50} was not determined. This is in line with the work by Patrick *et al*. (2011), who observed no mortality up to the maximum dose level of 8000 mg/kg body weight of *Jatropha tangorensis* leaf administered orally.

Table 1. Acute oral toxicity of *Jatropha tanjorensis* leaf extract.

Groups	Number of rats	Mortality
Treated with 10 mg/kg b.w	3	0
Treated with 100 mg/kg b.w	3	0
Treated with 1000 mg/kg b.w	3	0
Treated with 1600 mg/kg b.w	3	0
Treated with 2900 mg/kg b.w	3	0
Treated with 5000 mg/kg b.w	3	0

The result above showed no acute toxicity of the leave though lost appetite was seen in 5000 mg/kg but no mortality was recorded.

3.2. Preliminary phytochemicals content of Jatropha tanjorensis leaf

The leaf of *Jatropha tanjorensis* showed to possess appreciable presence of phytochemicals such as flavonoids, tannins, saponin, alkaloids, steroids and phenols. Among the phytochemicals analyzed in this study, *Jatropha tanjorensis* leaf showed to be abundant in flavonoids and phenols with the absence of cardiac glycoside, according to the outcome of this analysis as seen in Table 2. Phytochemicals present in plants are responsible for preventing disease and promoting health and have been studied extensively to establish and understand the underlying mechanism of their action and findings suggested that phytochemicals reduce the risk of coronary heart disease by preventing the oxidation of low-density liproproteins (LDL), normalizing blood pressure and clotting, improving arterial elasticity and preventing and treating cancer (Mathai *et al.*, 2000). Phytochemicals have been promoted for the prevention and treatment of diabetes, high blood pressure and macular degeneration (Mathai *et al.*, 2000).

Table 2. Preliminary phytochemicals content of *Jatropha tanjorensis* leaf extract.

Phytochemicals	Inference
Flavonoids	++
Tannins	+
Saponin	+
Alkaloids	+
Cardiac glycoside	-
Steroids	+
Phenols	++

3.3. Effect of the Jatropha tanjorensis leaf extract on rat blood glucose levels

The scientific base for the effectiveness of this plant was ascertained. In the course to determine a scientific prove for the effectiveness of this plant in the treatment of diabetes, it was decided to develop experimental design of antidiabetic activity by following alloxan-induced model. Normoglycemic male albino rats were used in order to assess the ability of the 99% ethanol extract of *Jatropha tanjorensis* leaf in exerting a blood glucose lowering effect. The extract showed reasonable hypoglycemic activity (Figure 1). The extract at the various doses used, significantly ($P<0.05$) reduced the blood glucose level when compared with the negative control group (untreated diabetic rats). When compared with glibenclamide at 5 mg/kg b.wt (which showed a blood glucose lowering capacity of 40%), the dose of 600 mg/kg b.w. of the extract exhibited equipotent glucose lowering potential (39.53%). The 400 and 200 mg/kg b.w of extract showed blood glucose lowering capacity of 32.38% and 28.88% on the 14 th day of study, respectively.

As hypothesized, in the negative control, there was severe hyperglycemia. It was revealed that the positive control which was administered with the standard drug (glibeclamide) lowered the blood glucose level significantly ($P<0.05$) in a time-dependent manner. The single dose of ethanol extract (600 mg/kg b.w) of *Jatropha tangorensis* significantly ($P<0.05$) reduced the blood level which was comparable to the positive control on 4th, 9th and 14th day of study while 400 mg/kg b.w and 200 mg/kg of *Jatropha tangorensis* significantly ($P<0.05$) reduced the blood glucose level as compared to negative control.

This implies that methanol leaves extract of *Jatropha tangorensis* is effective in reduction of blood glucose level in the experimental diabetic rats when compared to glibenelamide. This observation could be as a result of phytochemical the plant contains. According to Ehimwenma and Osagie (2007), phytochemical screening of *Jatropha tangorensis* leaf revealed that it contains bioactive principles such as alkaloids which is responsible for the antidiabetic activity. This study suggest that alkaloid contained in *Jatropha tangorensis* inhibited gloucose-6-phosphatase activity. It was found to be effective to control T2DM condition by alternating PEPCK, aldose reductase and TNF- α expression. At the same time, it increased the expression of glucokinase and Glu 4 (Shamma *et al.*, 2010).

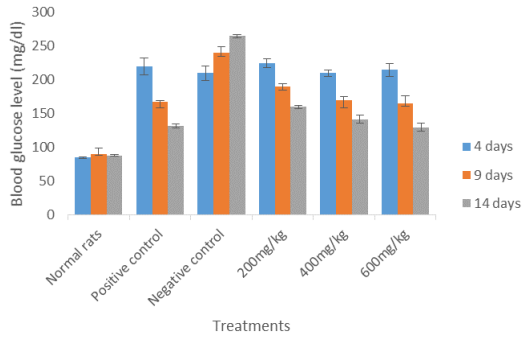

Figure 1. Effect of the *Jatropha tanjorensis* leaf extract on rat blood glucose levels.

3.4. Effect of the Jatropha tanjorensis leaf extract on liver function parameters

The result of the effect of *Jatropha tanjorensis* leaf extract on liver function parameters was shown in Table 3. The serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) activities and bilirubin concentration were significantly (P<0.05) increase in the diabetic untreated control when compared with the normal control. There was also significant (P<0.05) reduction in the albumin concentration of the diabetic untreated control when compared with the extract treated groups. Whereas the diabetic rats treated with 5 mg/kg glibenclamide, 200, 400 and 600 mg/kg b.w *Jatropha tanjorensis* leaf extract showed significant (P<0.05) reduction in the serum aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) activities and bilirubin concentration when compared with the disease group. There was significant (P<0.05) increase in the albumin concentration of the diabetic untreated control when compared with the extract treated groups. There were no significant (P>0.05) differences in the activities of serum liver function parameters analyzed in this study in the 600 mg/kg extract-treated groups in comparison with the positive control.

The quantification of the activities of different enzymes in body fluids play a vital role in disease investigation and detection of damaged tissues (Molomo, 2000). Marker enzymes tend to leak into the serum or other part of the system as a result of injury to the cell where they are localized. The serum elevation of AST, ALT and ALP are signs of leakage into the blood stream due to liver damage.

Alanine aminotransferase is the most sensitive marker for liver cell damage (Meyer and Kulkami, 2001). Albumin maintains osmotie pressure and helps transport certain blood constituents. Low blood albumin is a well established risk factor of morbidity and mortality (Coulthard, 2015). It can be caused by liver disease, malnutrition, excess excretion by the kidneys and wasting among others (Ungaro *et al.*, 2007). The results of the albumin concentration were in agreement with the work done by Atamgba (2018) which reported elevation of albumin in rats as a result of administration of high doses of *Jatropha tangorensis*. High serum albumin level has been reported as a predictor of favourable response to immune therapy in autoimmune encephalitis (Jang *et al.*, 2018). It is worthy to recall that bilirubin is a conventional indicator of liver diseases and its increase in the serum has been related to hepatocellular damage and hepatic biliary tract obstruction.

Table 3. Effect of the *Jatropha tanjorensis* leaf extract on liver function parameters of alloxan induced diabetes in experimental rats

Groups	AST (U/L)	ALT (U/L)	ALP (U/L)	Albumin (mg/dL)	Bilirubin (mg/dL)
Normal rats	83.54±2.73^{c}	91.79± 1.50^{b}	111.38±2.40^{c}	4.85 ±0.09^{c}	1.00±0.04^{c}
Positive control	68.22 ± 2.73^{a}	71.99± 1.50^{a}	93.29± 2.40^{a}	4.23±0.09^{a}	0.74±0.04^{a}
Negative control	105.43±2.73^{d}	111.18± .50^{d}	136.46±2.40^{d}	2.90±0.09^{d}	1.96±0.04^{d}
Treated with 200 mg/kg of extract	81.23±.73 ^{c}	84.17± 1.50^{c}	103.12±2.40^{b}	4.40±0.09^{ab}	0.99±0.04^{c}
Treated with 400 mg/kg of extract	73.67±2.73^{b}	89.55±1.50^{b}	95.50±2.40^{a}	4.17±0.09^{a}	0.81±0.04^{b}
Treated with 600 mg/kg of extract	66.55±2.73^{a}	71.85±1.50^{a}	92.73± 2.40^{a}	4.49±0.09^{b}	0.70±0.04^{a}

The above results are mean ±SD of triplicate determination. Different alphabets in same column differ significantly (P<0.05).

3.5. Effect of the Jatropha tanjorensis leaf extract on renal function parameters

The results in Table 4 revealed that the positive control and the extract at higher concentration (600 mg/kg b.w) significantly (P<0.05) reduced the creatinine level when compared to the negative control. There was non-significant (P<0.05) difference in the creatinine level of the 200 mg/kg b.w and 400 mg/kg b.w extract treated group compared to the normal control. This shows that *Jatropha tanjorensis* has the potential to improve kidney function. The results also revealed that *Jatropha tanjorensis* leaf had noticeable reduction in urea. There was non-significant (P<0.05) difference in the urea level of the 600 mg/kg b.w extract treated group and the positive control (Table 4) which suggests positive effect on the functional integrity of the kidney.

Interestingly, an important indicator of renal health is the serum creatinine because it is an easily measured by product of muscle metabolism that is excreted unchanged by the kidneys. The consistent release of creatinine into the body fluids at a constant rate and constancy of plasma levels of creatinine 24 h of the day makes creatinine a useful substance (Aboyade *et al.*, 2009). Urea is the major nitrogen containing metabolize product of protein metabolism. Serum reduction of urea may be attributed to improvement in physiological excretion of urea as a result of administration of plant extract.

Table 4. Effect of the *Jatropha tanjorensis* leaf extract on renal function parameters of alloxan induced diabetes in experimental rats

Groups	Urea (mg/dL)	Cratinine (mg/dL)
Normal rats	25.26±1.15^{b}	5.58±0.37^{b}
Positive control	19.16±.1.15^{a}	3.82± 0.37^{a}
Negative control	38.47±1.15^{d}	7.20±0.37^{d}
Treated with 200 mg/kg of extract	27.26±1.15^{c}	5.12±0.37^{b}
Treated with 400 mg/kg of extract	23.62±1.15^{b}	4.92±0.37^{b}
Treated with 600 mg/kg of extract	20.02±1.15^{a}	3.97±0.37^{a}

The above results are mean ±SD of triplicate determination. Different alphabets in same column differ significantly (P<0.05).

3.6. Effect of the Jatropha tanjorensis leaf extract on lipid profile

The result in Table 5 revealed that the positive control and the extract at various concentration significantly (P<0.05) reduced the low density lipoprotein (LDL), very low density lipoprotein (VLDL), total cholesterol and Triacylglycerol (TAG) compared to the negative control. The observed reduction in LDL, VLDL, total cholesterol and TAG by extract of *Jatropha tanjorensis* can be ascribed to the phytochemicals constituents in the extract which could be used to prevent cardiovascular complications arising from hyperlipidemia (Kosmas *et al.*, 2018).

Table 5. Effect of the *Jatropha tanjorensis* leaf extract on lipid profile of alloxan induced diabetes in experimental rats.

Groups	CHOL (mg/dL)	TAG (mg/dL)	HDL (mg/dL)	LDL	VLDL
Normal rats	153.05±2.58^{d}	185.73±5.57^{d}	66.50±2.93^{b}	49.40±1.89^{d}	37.15±1.08^{d}
Positive control	124.53± 2.58^{a}	135.09±5.57^{a}	78.84±2.93^{c}	18.67±1.89^{b}	27.02±1.00^{a}
Negative control	191.18±2.58^{e}	276.21±5.57^{e}	50.98±2.93^{a}	84.96±1.89^{e}	55.24±0.91^{e}
Treated with 200 mg/kg of extract	141.65±2.58^{c}	171.42±5.57^{c}	72.93±5.57^{c}	72.93±2.93^{c}	34.28±1.18^{c}
Treated with 400 mg/kg of extract	131.49±2.58^{b}	155.23±5.57^{b}	81.55±2.93^{c}	18.89±1.89^{b}	31.05±1.32^{b}
Treated with 600 mg/kg of extract	128.10±2.58^{a}	141.03±5.57^{a}	88.34±2.93^{d}	11.56±1.89^{a}	28.20±1.44^{a}

The above results are mean ±SD of triplicate determination. Different alphabetic in same column differ significantly (P<0.05).

Thus, there was significant (P<0.05) increase in high density lipoprotein (HDL) cholesterol in the test group when compared with negative control. Recent studies have shown that HDL may directly alter glucose

metabolism by promoting pancreatic B-cell insulin secretion and modifies glucose uptake in skeletal muscle (Drew *et al.*, 2009), while low levels of HDL has been suggested to be associated with higher risk of type 2 diabetes in epidemiological studies (Wilson *et al.*, 2007).

3.7. Effect of the Jatropha tanjorensis leaf extract on hematological indices

Hematologicalindices have a high diagnostic significance in routine clinical evaluation of health condition, the result revealed that the leaf extract of *Jatropha tangorensis* significantly (P<0.05) increased the level of hemoglobin (Hb), Packed Cell Volume (PCV), Red Blood Cell (RBC) and Platelets concentrations in the test groups when compared with the negative control (Table 6). This findings is in line with observation made by Omoregie and Osagie (2012). There was significant (P<0.05) increase in white blood cell (WBC) in the extract treated groups when compared with negative control.

The increase of RBC is an indication that the extract may induced elevation of erythropoietic mechanism in the animals. Hemoglobin can play a role in assessing total erythropoiesis and the amount of erythropoietic activity that is effective in producing circulating red cells while platelets play a vital role in the prevention of blood loss by adhering to exportedcollagen to form platelet plug.

Table 6. Effect of the *Jatropha tanjorensis* leaf extract on hematological indices of alloxan induced diabetes in experimental rats.

Groups	Hb (g/dl)	PCV (%)	RBC(10^6/l)	TWBC ($\times10^9$/L)	Platelets ($\times10^9$/L)
Normal Rats	8.80 ±0.04^b	26.20±0.28^b	28.30±0.14^c	5.30±0.14^b	215.00±7.07^a
Positive Control	7.90±0.07^c	25.40±1.13^c	24.50±0.07^d	4.20±0.21^e	199.50±0.70^c
Negative Control	6.50±0.42^d	19.10±1.55^e	18.00±0.28^f	6.75±0.07^a	161.00±1.41^e
200mg/kg	7.70±0.14^c	22.20±0.28^d	22.00±0.00^e	4.50±0.14^d	188.00±1.41^d
400mg/kg	9.10±0.14^b	27.65±0.63^b	29.20±0.28^b	4.80±0.07^c	200.50±1.41^d
600mg/kg	9.60±0.28^a	30.20±0.28^a	31.30±0.14^a	4.60±0.14^c	206.00±1.41^b

The above results are mean ±SD of triplicate determination. Different alphabetic in same column differ significantly (P<0.05).

4. Conclusion

The findings from this study showed that the ethanol extract of *Jatropha tamjorensis* leaf has the potential of reducing blood glucose level, maintaining hematological indices, preventing hyperlipidaemia and protecting against hepatic and renal damage in treated rats, hence, demonstrating a antidyslipidaemia, hepatoprotective and nephroprotective properties that appears to be very significant in the management of diabetes.

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