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# Effect of *Parkia biglobosa* seed on lipid profile of dexamethasone-treated pregnant rats

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## Abstract

This study was aimed at evaluating the effect of *Parkia biglobosa* seed on dexamethasone-treated pregnant rats. Locust bean seeds were purchased from an open market in Ado Ekiti, Nigeria. It was processed and ground into powder which was subsequently used in formulating feed for experimental animals. Fifteen female pregnant rats were divided in three groups of five each. Animals in group A were exposed to standard animal feed only. This served as the control group. Those in group B were exposed to animal feed mixed with locust beans + 0.3 mg/kg body weight of dexamethasone, while those in group C were exposed to animal feed mixed with locust beans. At the end of eight days treatment, animals were sacrificed and blood sample was collected into EDTA bottles and centrifuged. Plasma was separated and used for the determination of glucose and lipid profile. Exposure of animals to dexamethasone was observed to significantly ($p<0.05$) increased the concentration of plasma glucose concentration when compared with the control as well as animals treated with *P. biglobosa* only. Animals treated with dexamethasone along with *P. biglobosa* were observed to have higher concentrations of triglyceride, total cholesterol, low density lipoprotein (LDL) and very low density lipoprotein (VLDL) when compared with those in animals in the control group as well as those treated with *P. biglobosa* only. Observations from this study revealed that dexamethasone adversely perturbed and unhinged plasma glucose and lipid profile in female pregnant rats while *P. biglobosa*-formulated diet was observed to be a potent hypoglycemic and hypolipidemic agent.

**Keywords:** Dexamethasone; Glucose; Lipid Profile; *Parkia biglobosa*

## 1. Introduction

*Parkia biglobosa* (locust bean) has long been widely recognized as an important indigenous multipurpose fruit tree whose uses include food, medicine, manure, tannin, shade, wind breaks, bee food, stabilization of degraded environment, livestock feed, fuel, fibre, fish poison and several other domestic uses [1]. *Parkia biglobosa* has many medicinal uses in Africa [2]. It provides an ingredient that is used in treating leprosy and hypertension [3]. It has been identified as one of the candidates with promising therapeutic potential in the prevention, treatment, and management of a number of metabolic diseases including diabetes mellitus [4]. According to Tokoudagba *et al.* [5], *P. biglobosa* leaf extracts induce redox-sensitive endothelium-dependent relaxations in porcine coronary artery rings thereby acting as an antihypertensive agent. The leaves are used in lotions for sore eyes, burns, haemorrhoids and toothache [2]. A decoction of the leaves, bark and roots are used in treating leprosy, eye sores, toothache, fever, hypertension, wounds and ulcers [6]. Airaodion et al. [7], has reported that *P. biglobosa* seed possesses hepatoprotective ability. In another study, Airaodion and Ogbuagu [8] observed that *P. biglobosa* seed ameliorated hypertension.

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Coronary heart disease (CHD) or cardiovascular diseases are recognized to be one of the most important reasons of morbidity and mortality and imposes tremendously heavy socio-economic burden worldwide. There are varieties of risk factors in the literature which increases the incidence of CHD such as hyperlipidemia [9-11]. CHD occurs when cholesterol accumulates on the artery walls, creating plaques. Reduced blood flow occurs when one or more of these arteries become partially or completely blocked. The four primary coronary arteries are located on the surface of the heart are: right, left main coronary artery, left circumflex artery and left anterior descending artery [12]. CHDs are the most predictable cause of sudden death. For many years, CHD prevalence was believed to be relatively low in developed countries. Recent studies have indicated a remarkably high proportion of mild to severe CHD in a number of patients [13].

According to the guidelines of the American Heart Association, the following values are prescribed for the above-mentioned risk factors for cardiovascular disease: total cholesterol: <200 mg/dL; triglycerides: <200 mg/dL; HDL: >40 mg/dL; and LDL: <130 mg/dL [14]. The lipid profile is a group of tests that are often done together to identify the risk of heart disease. These tests are good indicators of predisposition to a heart attack or stroke caused by the blockage of blood vessels or hardening of the arteries [15]. This study is therefore aimed at evaluating the effect of *P. biglobosa* (locust bean) seed and its attenuative potential in dexamethasone treated-rats.

## 2. Materials and Methods

### 2.1. Collection and Preparation of Materials

Locust bean seeds were purchased from an open market in Ado Ekiti, Nigeria. They were authenticated by the Chief botanist of the Department of Plant Science, Ekiti State University, Ado-Ekiti and deposited in the University's Herbarium with Voucher number UHAE-2020063. They were selected for any possible dirt and was rinsed thoroughly with water, after which, they were soaked in a cold water for about 15 minutes and boiled in a pressure pot for 2 hours, followed by de-hulling and stepping/matching on the boiled locust beans and washing with cold water, it was re-washed and cooked for 45 minutes to make it softer and rinsed using a plastic sieve. It was fermented to produce the food condiment which is used as soup seasoning/spices (flavoring agent). This was done by spreading the boiled locust beans into a fermenting can and wrapped with cloth for 48 hours to prevent oxygen. Subsequently, the fermented *P. biglobosa* seeds were air dried for 3 days and was milled into powder using an electric blender and stored for further analysis.

### 2.2. Experimental Design

Twenty one Albino rats (6 males and 15 females) were obtained from the Animal House, Faculty of Basic Medical Sciences, College of Medicine, Ekiti State University, Ado-Ekiti. They were grouped into three of 2 males and 5 females in each group using plastic cages with steel wire lids to copulate, since the experiment requires the female Albino rats to be pregnant. They were kept at room temperature with adequate access to rat chow and water throughout the experimental period. After a week of copulation, all the female Albino rats were confirmed pregnant by the animal house technician. The males rats were removed from their cages and the female pregnant rats were treated as follows: animals in group A were exposed to standard animals feed only. This served as the control group. Those in group B were exposed to animal feed mixed with locust beans + 0.3 mg/kg body weight of dexamethasone, while those in group C were exposed to animal feed mixed with locust beans. At the end of the eight days treatment, animals were sacrificed and blood sample was collected into EDTA bottles and centrifuged. Plasma was separated and preserved at 4 ℃ for determination of lipid profile.

### 2.3. Determination of Biochemical Parameters

Plasma glucose concentration was determined according to the methods of described by Barham and Trinder [16] (Dialab, Austria) while lipids were extracted and determined according to the methods previously described by Owoade et al. [17,18].

### 2.4. Statistical Analysis

Data were subjected to analysis of variance using Graph Pad Prism. Results were presented as Mean ± Standard deviation. One way analysis of variance (ANOVA) was used for comparison of the means followed by Tukey's post hoc test. Differences between means were considered to be significant at $p<0.05$.

## 3. Results

Exposure of animals to dexamethasone was observed to significantly ($p<0.05$) increased the concentration of plasma glucose concentration when compared with the control as well as animals treated with *P. biglobosa* only (figure 1). Animals treated with dexamethasone along with *P. biglobosa* were observed to have higher concentrations of triglyceride, total cholesterol, low density lipoprotein (LDL) and very low density lipoprotein (VLDL) when compared with those in animals in the control group as well as those treated with *P. biglobosa* only as presented in figures 2-5.

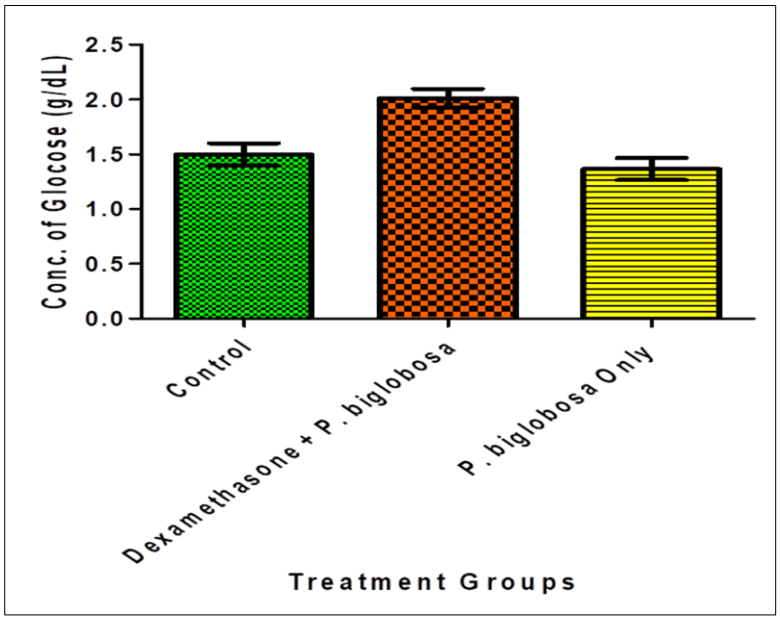


**Figure 1** Effect of *P. biglobosa* on the Concentration of Plasma Glucose of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

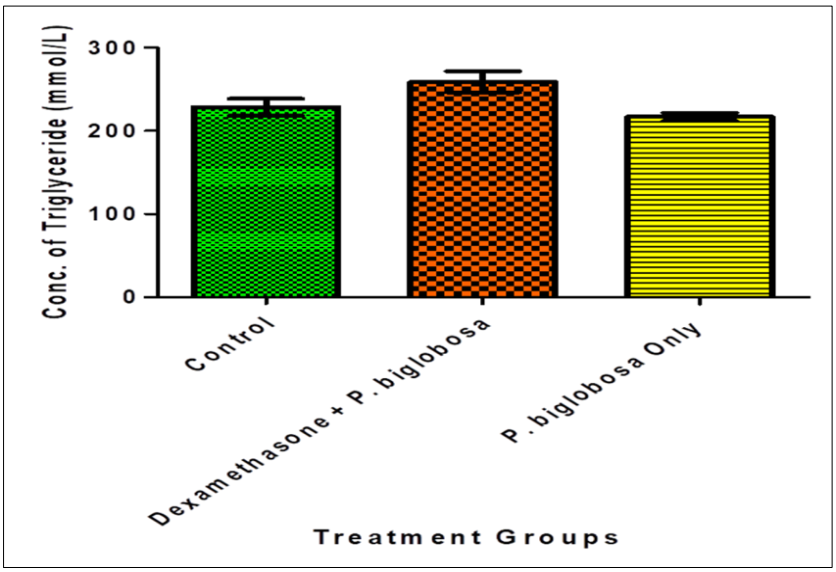


**Figure 2** Effect of *P. biglobosa* on the Concentration of Plasma Triglyceride of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

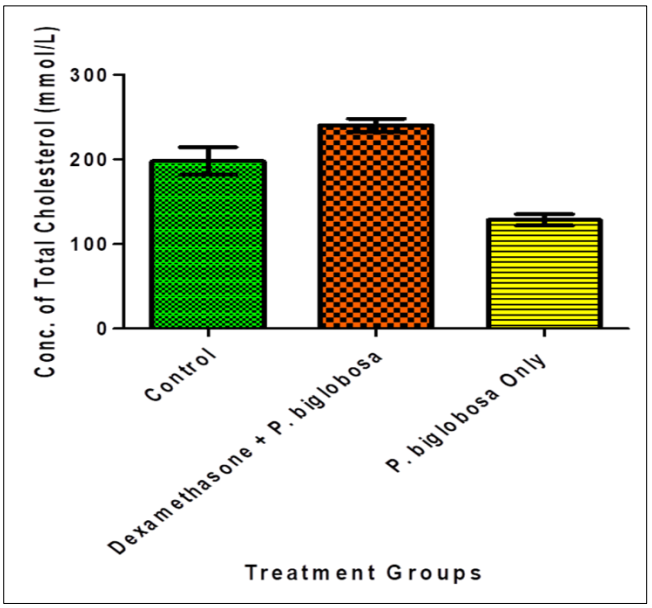


**Figure 3** Effect of *P. biglobosa* on the Concentration of Plasma Total Cholesterol of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

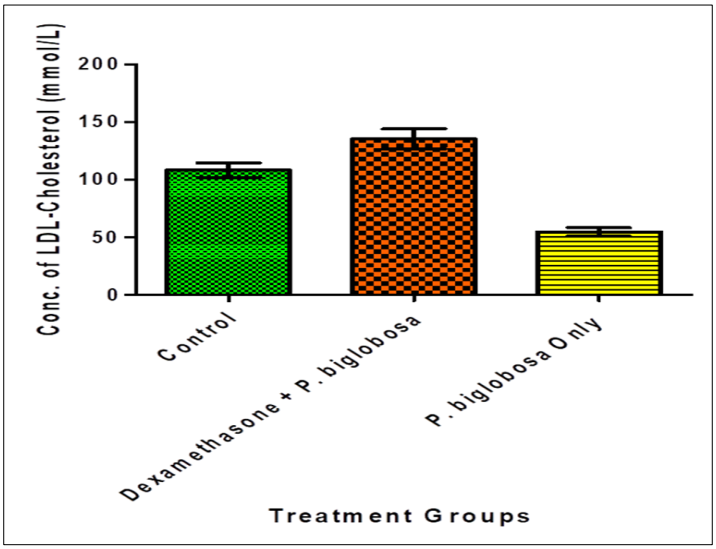


**Figure 4** Effect of *P. biglobosa* on the Concentration of Plasma Low Density Lipoprotein (LDL) Cholesterol of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

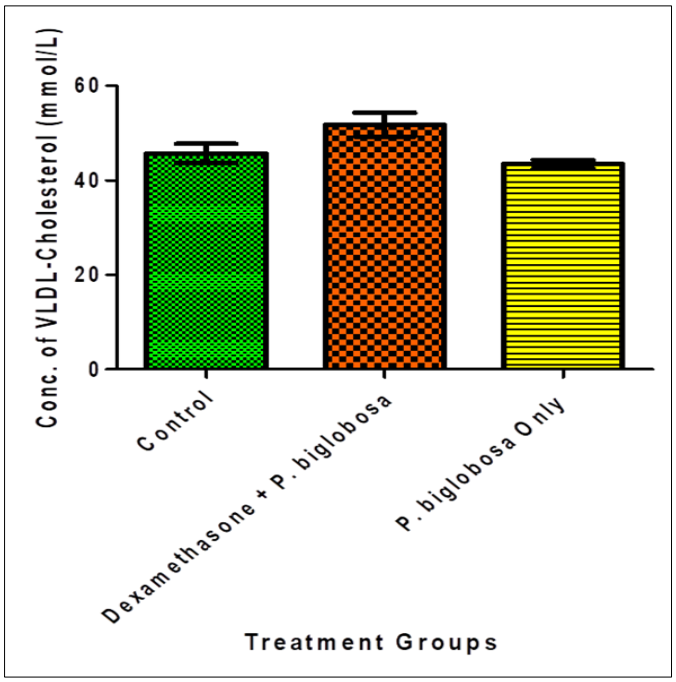


**Figure 5** Effect of *P. biglobosa* on the Concentration of Plasma Very Low Density Lipoprotein (VLDL) Cholesterol of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

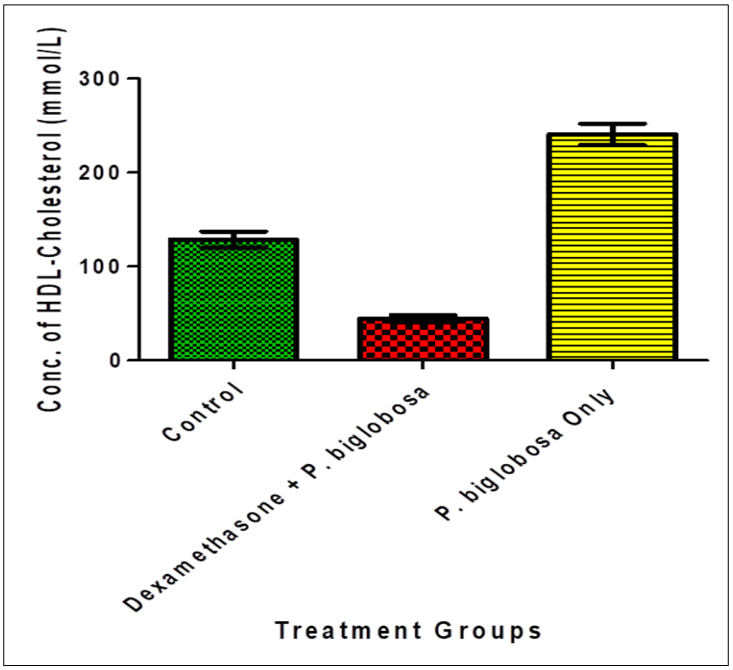


**Figure 6** Effect of *P. biglobosa* on the Concentration of Plasma High Density Lipoprotein (HDL) Cholesterol of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

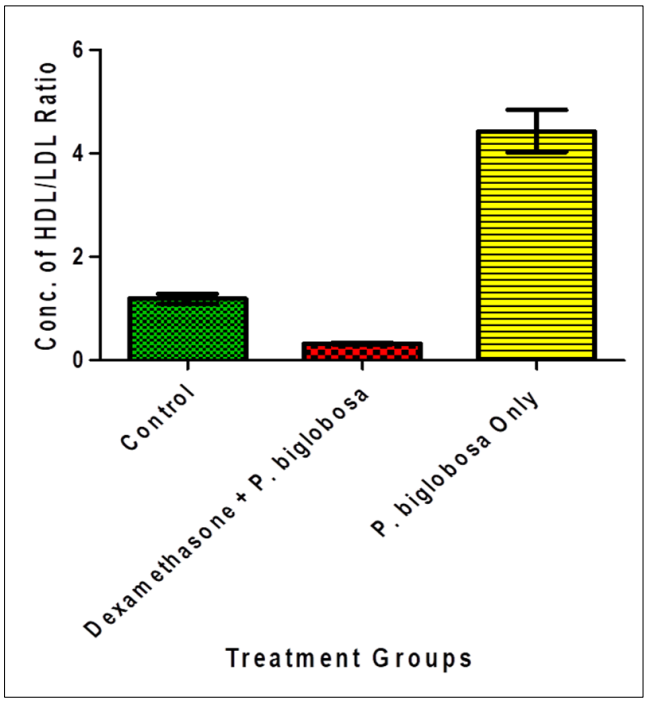


**Figure 7** Effect of *P. biglobosa* on the Concentration of Plasma HDL/LDL Ratio of Dexamethasone-Treated Pregnant Rats

Results are presented as mean±standard deviation with n =5.

## 4. Discussion

Exposure of animals to dexamethasone was observed to significantly ($p<0.05$) increased the concentration of plasma glucose when compared with the control as well as animals treated with *P. biglobosa* only (figure 1). This corresponds to the findings of Niu et al. [19] who treated goats with dexamethasone. It also agrees with the observation of Hans et al. [20] who studied the blood glucose concentration profile after 10 mg dexamethasone in non-diabetic and type 2 diabetic patients undergoing abdominal surgery. In an earlier report, Chap et al. [21], observed that dexamethasone significantly increased glucose concentrations in conscious dogs. Bernal-Mizrachi et al. [22], had previously reported that dexamethasone induced diabetes, thus confirming its hyperglycemic effect observed in this study. However, animals exposed to *P. biglobosa* only were observed to have lower plasma glucose when compared with those in the group exposed to dexamethasone. The glucose-lowering effect of *P. biglobosa* observed in this study is in conformation with the report of Airaodion et al. [4] who studied the effect of oral intake of *P. biglobosa* on fasting blood sugar and lipid profile of albino rats. Several extracts of different plants have also been reported to have an antihyperglycemic potential as well as insulin-stimulatory effect [23-26]. Most of the plants extracts with hypoglycemic activities have been found to contain secondary metabolites such as glycosides, alkaloid and flavonoids [27-29].

Chemical investigation of *P. biglobosa* has shown that they contain cardiac glycosides and alkaloids [30]. These chemical substances may then be responsible for the hypoglycemic effect of *P. biglobosa* observed in this study. The plasma glucose reducing effect of *P. biglobosa* could also an indication that it possesses antidiabetic properties which could control hyperglycemia. It has been reported that one of the approaches in the treatment of early stage of diabetes is to decrease post-prandial hyperglycemia [31,32]. This is done by slowing down the absorption of glucose through the inhibition of the carbohydrate-hydrolyzing enzymes, α-amylase and α-glucosidase in the digestive tract [32]. Consequently, inhibitors of these enzymes cause a decline in the rate of glucose absorption and thus blunting the post-prandial plasma glucose increase [33]. Based on these investigations, it could be suggested that *P. biglobosa* may inhibit platelet aggregation and enhance vasodilatation, exerting a vital protective role in the prevention of the development and progression of vascular complications caused by the hyperglycemic state. In fact, researches have shown that polyphenolic compounds present in some plant extracts has the ability to inhibit the process of thrombus formation [34,35].

In this study, exposure of animals to dexamethasone was observed to significantly ($p<0.05$) increased the concentrations of lipids (except HDL) when compared with those in animals in the control group as well as animals treated with *P. biglobosa* only. Dexamethasone has been reported to induce diabetes and dyslipidemia [22]. It has also been reported to induce hypertension [36]. The result of this study is in agreement with that of Krupková et al., [37] as well as that of Kamel et al., [38]. Dexamethasone belongs to the group of synthetic corticosteroids that has important anti-inflammatory and anti-allergic influences and results in the pain of inflammatory processes, especially in joints. Also, dexamethasone outcomes in the destruction of the immune method, and these effects can often influence different systems of the body [39]. Delaying the healing of wounds, affliction with diabetes, the effect on the balance of body fluids and electrolytes that results in retention of salt and water in the body, the effect on the distribution of lipids in the body and consequently the quantity of lipids in specific sections of the body such as back of the neck, increase of hypertension, blood sugar and excessive hairs in different parts of the body such as face, especially in females, being among the other adverse effects of inappropriate and excessive use of this ampule [40]. The effect of dexamethasone on the lipid profile of female pregnant rats used in this study also corresponds to the findings of Arab and Mahboubi [39], who exposed adult male rats to dexamethasone

It is worthy of note that animals exposed to *P. biglobosa* only had significantly lower lipid concentrations (except triglyceride and HDL) when compared with those in animals in the control group as well as animals treated with dexamethasone. The effect of *P. biglobosa* on the lipid profile of female pregnant rats used in this study is similar to the report of Airaodion et al. [4] who exposed adult male rats to *P. biglobosa* extracts. This could be suggestive that *P. biglobosa* may prevent the progression of cardiovascular diseases. Despite the availability of known anti-diabetic medications, remedies from medicinal plants are used with increasing success to treat this disease and manage its complications better [41]. Furthermore, it has been suggested that plant drugs and herbal formulations are less toxic and are free from side-effects compared with synthetic drugs, leading to an increasing preference for traditional plants over synthetic drugs [42-45]. Increased evidence of therapeutic effectiveness of herbal medicines may have influenced the interest of the WHO in hypoglycemic agents of plant origin used in the traditional treatment of diabetes [46].

## 5. Conclusion

Observations from this study revealed that dexamethasone adversely perturbed and unhinged plasma glucose and lipid profile in female pregnant rats while *P. biglobosa*-formulated diet was observed to be a potent hypoglycemic and hypolipidemic agent.

## Compliance with ethical standards

### *Acknowledgments*

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### *Disclosure of conflict of interest*

Authors have declared that no conflict of interests exist in this study and publication.

### *Statement of ethical approval*

The use of animals for this study was approved by the Experimental Animal Research Ethics Committee of Ekiti State University, Ado-Ekiti with ethical approval number ORD/ETHICS/AD/043

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