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Original Article

Antidiabetic and antilipidemic effects of *Andrographis paniculata* ethanolic root extract in alloxan induced diabetic rats

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Lipid Profile Total Protein and
Serum Albumin

Abstract

This investigation was aimed at finding the antidiabetic and antilipidemic potentials of *Andrographis paniculata* roots extract in Alloxan induced diabetic rats. Sixty female rats were used for the study and diabetes was induced into 50 rats by intraperitoneal injection of Alloxan while 10 were not induced. They were shared into six (6) study groups of 10 rats each and designated as; positive control group (NDC) placed on water and feeds, negative control group (DC) Alloxan induced but untreated, diabetic group treated with insulin and 3 diabetic groups (DAP1, DAP2, DAP3) administered ethanolic root extract at varying concentration of 200mg/kg, 400mg/kg and 800mg/kg B.W respectively for 7 days. Fasting blood glucose and body weight indices were monitored during the experimental period. Animals treated with insulin and *Andrographis paniculata* root extract shows significant decrease in their glucose concentration compared with the diabetic control (DC) at ($p<0.05$) at varying concentration. There was a significant decrease in the LDL level of the treated groups as against an increment in DC with relations to the NDC group. TAG was significantly decreased and HDL was significantly increased in the extract treated Group at 800mg/kg but significantly increased at 200mg/kg, 400mg/kg and insulin group. Serum albumin was also increased in like manner at ($p<0.05$). Total protein for the treated groups were increased significantly compared to the diabetic control group.(DC) which was significantly reduced compared to the non-diabetic control group (NDC) at ($p<0.05$) at varying concentration. The extract was found to be non-toxic as seen by the extract fed normal rats of *A. paniculata* root extract. In this present findings, *A. paniculata* roots extract possessed significant antihyperglycemic effect, as it lowers glucose concentration in the blood and lipid profile activity in alloxan induced diabetic rat.

1. Introduction

Medicinal plants have been identified and used throughout human history. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, and to defend against attack from predators such as insects, fungi and herbivorous mammals. Chemical compound in plants mediate their effect on the human in the same manner as conventional orthodox drug; thus herbal medicines do not differ greatly from conventional drugs in terms of their mechanism of action. This enables herbal medicines to have beneficial pharmacokinetics, but also gives them the same potential as conventional pharmaceutical drugs to cause deleterious effects [1-2]. Recent findings show that ethnobotany is an effective way to discover future medicines. In 2001, researchers identified 122 compounds used in modern medicine which were derived from "ethnomedical" plant sources; 80% of these had ethnomedical uses related to the current use of the active elements of the plant [3]. Many of the pharmaceuticals currently available to physicians are long time derivations of herbal remedies. Examples of such drugs include aspirin, digoxin, quinine, digitalis and opium [4]. The use of herbal medication is almost universal among non-industrialized countries and is often most affordable than modern pharmaceuticals. The World Health Organization estimates that 80% of some Asian and African countries presently use herbal medicine for some aspect of primary health care. Services in the United States and Europe have shown that their uses are less common in clinical settings, increasingly more common in recent years as scientific evidence on herbal medicine has become more widely acceptable. The annual global export value of pharmaceutical plants in 2011 accounted for over US$2.2 billion [5].

Diabetes Mellitus (DM) is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by greater or lesser impairment in the metabolism of carbohydrates, lipids and proteins. This condition is probably one of the oldest diseases known to man. It was first reported in Egyptian manuscript about 3000 years ago [6]. In 1936, the distinction between type 1 and type 2 DM was clearly made. Type 2 DM was first described as a component of metabolic syndrome in 1988 [7]. The origin and etiology of DM vary greatly but always include defects in either insulin secretion or response or in both at some point in the course of disease. Mostly patients with diabetes mellitus have either type 1 diabetes which is immune-mediated or idiopathic Type 2 DM formerly known as non-insulin dependent DM is the most common form of DM characterized by hyperglycemia, insulin resistance, and relative insulin deficiency [8].

2. Materials and methods

2.1 Chemicals

Ethanol, Chloroform, Alloxan and other Chemicals were obtained from Fam Lab Nigeria Limited Akure, Accucheck Active was purchased from Akol Pharmacy Oshogbo, Osun State Nigeria. The animal feed pallet was purchased from Osogbo Central Market, Osun State. All chemicals used were of analytical grade.

2.1.1 Source of drug

Insulin Injection (Randox laboratories, UK) marketed by May and Baker, was obtained from a registered pharmacist in De-shalom pharmacy, Ilesa, Osun State, Nigeria and used for the study.

2.2 Preparation of plant extract

Fresh and healthy plant roots of *Andrographics paniculata* was obtained from a plantation in Federal College of Agriculture Ijapo Akure, Ondo state, Nigeria. The plant sampkles were taken to the department of Botany, Obefemi Awolowo University (O.A.U) for identification and authentication. The *Andrographis paniculata* leaves were sorted out and thoroughly washed to get rid of the sand, the Roots were detached from the entire plant and allowed to air dry properly under a shade for 3 days. The dried plant roots were pulverized into powder and weighed in a weighing balance. The powder form was kept in an airtight container and stored until when needed for further analysis.

2.2 Experimental animals

Adult Sixty (60) female albino rats weighing between 190-200g were purchased from a disease free stock of the Ladoke Akintola University of Technology Oshogbo, Osun State and used for the study. The rats were randomly assigned on the basis of their weight into six study groups of ten (10) rats each. Normal feeds and clean running water were given to the rats ad-libitum. They were kept in a wooden cages of ten (10) rats each, placed in a well-ventilated animal house of Joseph Ayo Babalola University Ikeji Arakeji Osun State at normal temperature of 30-35^{o}C. The cages were cleaned regularly and the rats were treated according to the international guidelines for the care and use of laboratory animals (NIH, 1985). The animals were allowed for two week acclimatization and their weight taken before the commencement of treatment.

2.2.1 Induction of diabetes

Diabetes was induced by single intraperitoneal dose of 680mg/kg of alloxan was dissolved in 6.8ml of distilled water into 12 hours day time fasted rats and the rats having fasting blood glucose levels more than 200mg/dl were isolated, classified and used for experimentation

2.2.2 Experimental design

The grouping and treatment given to the rats in each group are as follows; Group A: Designated as NDC consisted of non-diabetic control rats received 1ml of distilled water Group B: Designated as DC consisted of diabetic Control rats received 1ml of Alloxan Group C: Designated as DO consisted of Diabetic Orthodox received1ml of Insulin Group D: Designated as DAP1 consisted of diabetic rats received 200mg of roots extract. Group E: Designated as DAP2 consisted of Diabetic rats received 400mg of roots extract. Group F: Designated as DAP3 consisted of Diabetic rats received 800mg roots extract.

2.2.3 Animal serum collection

At the end of the experimental period, rats in each study group were fasted overnight and sacrificed under anesthesia by cardiac puncture. After the rats were sacrificed, 2-5ml of blood was collected from each rat and placed in specific sterile bottles (lithium heparinized bottle for Chemistry test and EDTA bottles for hematological indices). For enzyme analysis the blood was allowed to stand for 30minutes to clot and then centrifuge at 4000r.p.m for 15 minutes. The supernatant, which is the serum was carefully decanted and was kept at 4^{0}C for further analysis.

2.3 Biochemical assay

2.3.1Total protein

Determined by Coomassie Brilliant dye-binding, the method of Lowry et al, 1951

2.3.2 Determination of albumin

The method was described by Plummer (1979) was used to determine the albumin concentration.

2.4 Statistical Analysis

All data obtained were expressed as Mean ± SEM (standard error of mean) of sample size, n=8. Significant difference between control and experimental groups were obtained by student's t-test using statistical package for social science (SPSS version 16). P-values <0.05 were considered significant.

3. Results

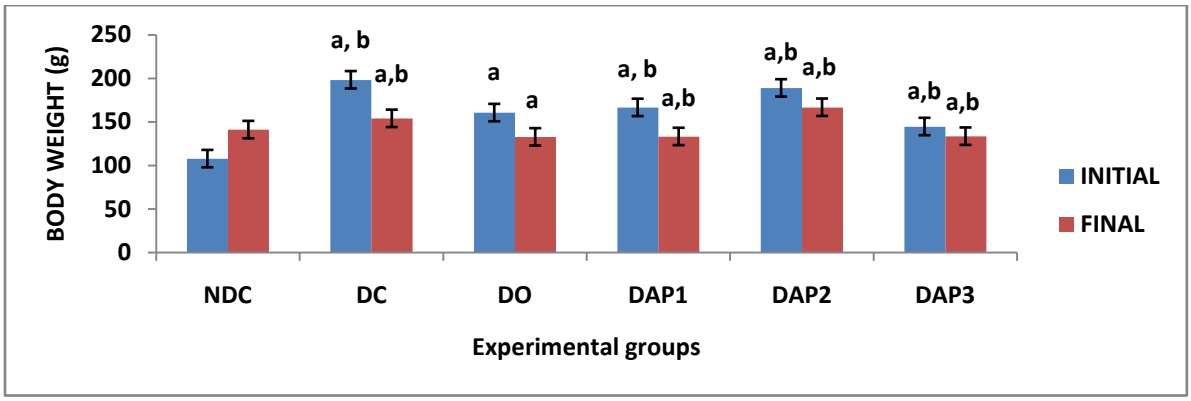

Figure 1.0: Effect of extract on body weight indices

Value expressed in mean ± SEM of 10 determinations

NDC: Non-Diabetic Control (positive control); DC: Diabetic Orthodox; DO: Diabetes Control (Negative control); DAP1: Diabetic *Andrographis paniculata* (200mg/kg body weight); DAP2: Diabetic *Andrographis paniculata* (400mg/kg body weight); DAP3: Diabetic *Andrographis paniculata* (800mg/kg body weight); a: shows significant difference when compared to positive control at ($p<0.05$); b: shows significant difference when compared to negative control at ($p<0.05$)

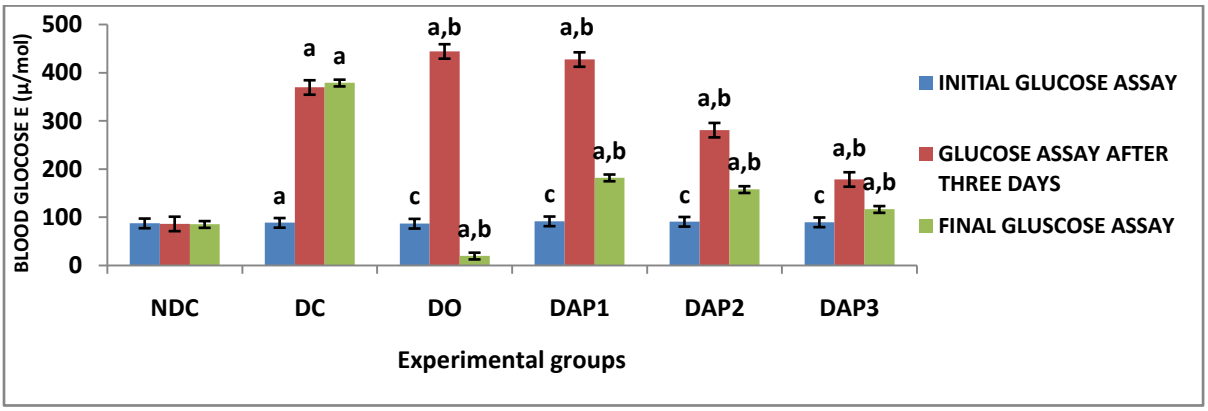

Figure 2.0: **Effect of extract on initial, intermediate and final blood glucose level.**

Value expressed in mean ± SEM of 10 determinations

NDC: Non-Diabetic Control (positive control); DC: Diabetic Orthodox; DO: Diabetes Control (Negative control); DAP1: Diabetic *Andrographis paniculata* (200mg/kg body weight); DAP2: Diabetic *Andrographis paniculata* (400mg/kg body weight); DAP3: Diabetic *Andrographis paniculata* (800mg/kg body weight); a: shows significant difference when compared to positive control at ($p<0.05$); b: shows significant difference when compared to negative control at ($p<0.05$); c: shows no difference when compared to both negative and positive control at ($p<0.05$)

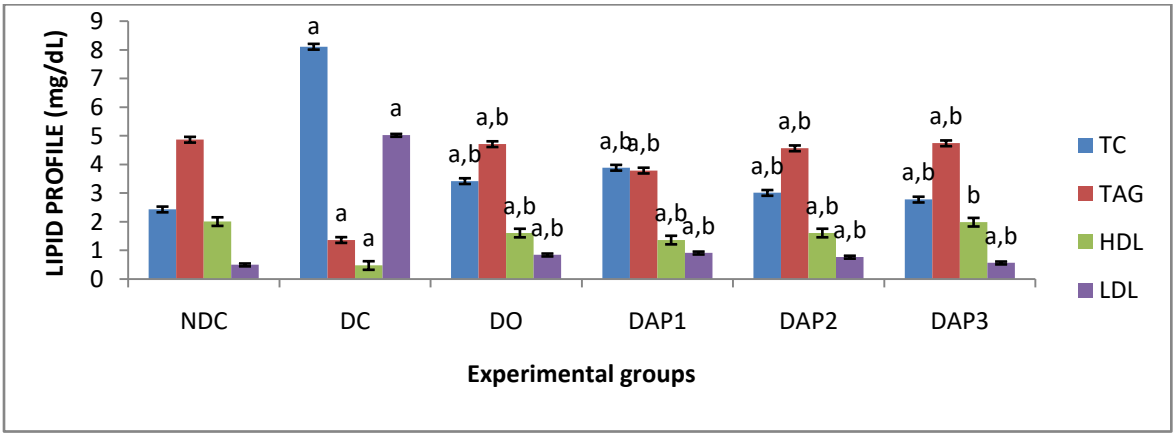

Figure 3.0: Effect of extract on lipid profile of experiment rats.

Value expressed in mean ± SEM of 10 determinations

NDC: Non-Diabetic Control (positive control); DO: Diabetic Orthodox; DC: Diabetes Control (Negative control); DAP1: Diabetic *Andrographis paniculata* (200mg/kg body weight); DAP2: Diabetic *Andrographis paniculata* (400mg/kg body weight); DAP3: Diabetic *Andrographis paniculata* (800mg/kg body weight); a: Indicates a significant difference when compared to positive control at ($p<0.05$); b: Indicates a significant difference when compared to negative control at ($p<0.05$)

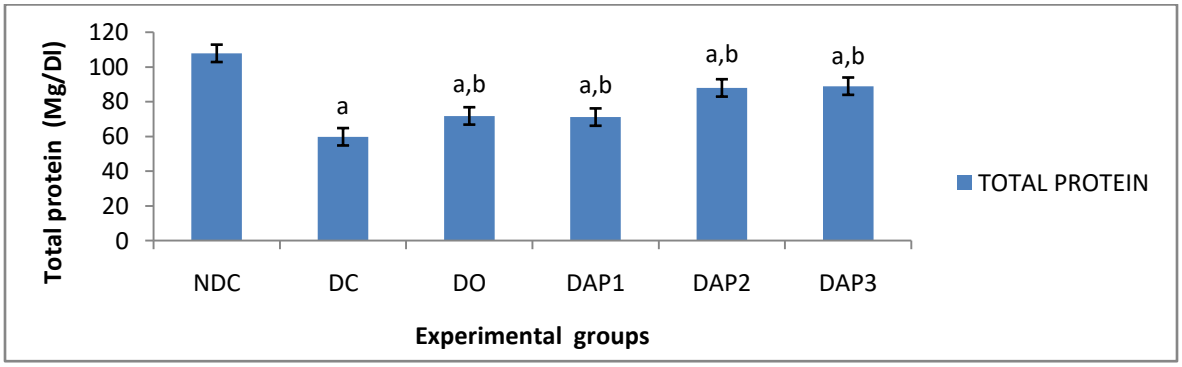

Figure 4.0: Effect of extract on total protein in experimented rats.

Value expressed in mean ± SEM of 10 determinations

NDC: Non-Diabetic Control (positive control); DC: Diabetic Orthodox; DO: Diabetes Control (Negative control); DAP1: Diabetic *Andrographis paniculata* (200mg/kg body weight); DAP2: Diabetic *Andrographis paniculata* (400mg/kg body weight); DAP3: Diabetic *Andrographis paniculata* (800mg/kg body weight); a: Indicates a significant difference when compared to positive control at ($p<0.05$); b: Indicates a significant difference when compared to negative control at ($p<0.05$)

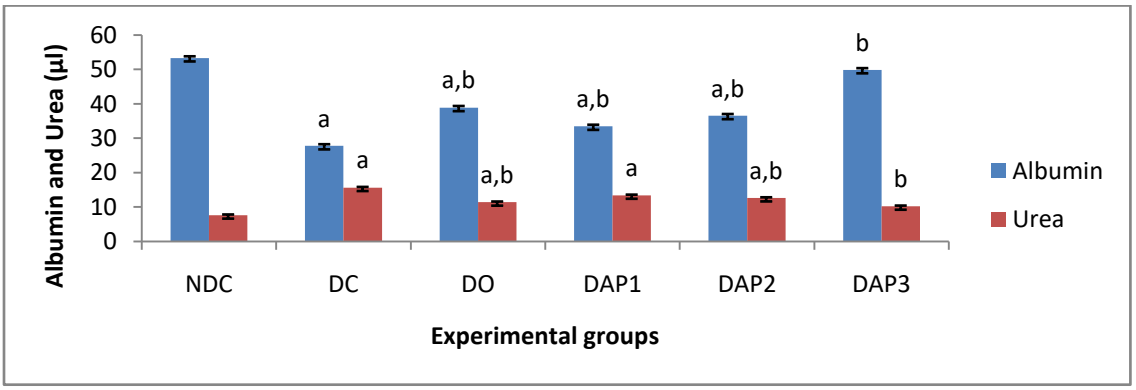

Figure 5.0: effect extract on albumin and urea concentration of experimented rats

Value expressed in mean ± SEM of 10 determinations

NDC: Non-Diabetic Control (positive control); DC: Diabetic Orthodox; DO: Diabetes Control (Negative control); DAP1: Diabetic *Andrographis paniculata* (200mg/kg body weight); DAP2: Diabetic *Andrographis paniculata* (400mg/kg body weight); DAP3: Diabetic *Andrographis paniculata* (800mg/kg body weight); a: shows significant difference when compared to positive control at ($p<0.05$); b: shows significant difference when compared to negative control at ($p<0.05$)

4. Discussion

This study was aimed at evaluating the antidiabetic and antilipidemic effects of *Andrographis paniculata* ethanolic root extract in alloxan induced diabetic rats. After the induction of diabetes in the rats by alloxan intraperetoneal method, diabetic conditions were observed in rats by weight loss, polyuria, polydipsia, polyphagia and declined physical activities. There was significant reduction ($p<0.05$) in the total cholesterol level of *Andrographis paniculata* treated diabetic rats in relation to non diabetic control, and also in insulin treated group, triglycerides level was also significantly increased in the treated groups when compared with the insulin treated group. High density lipoprotein (HDL) was significantly increased in the insulin treated group and in the group treated with *Andrographis paniculata* root extract but at high dosage (800mg/kg) and there was significant reduction in the LDL level of the treated diabetic group (800mg/kg) but no significant reduction in the diabetic rats with the insulin and extract at (200mg/kg and 400mg/kg) and the reduction in the LDL level of *Andrographis paniculata* treated diabetic rats substantiate the fact that treatment of hyperlipidaemia will benefit diabetic mellitus patients in decreasing coronary heart disease. The serum albumin of diabetic groups was significantly increased in comparison to non-diabetic control groups at different dosage. Above findings shows that induction of diabetes with alloxan and treatment with *Andrographis paniculata* extract has an effect on the synthetic functions of the liver in albumin production. It could be concluded that there are immunologic response as *Andrographis paniculata* was administered. Urea level showed significant increase compared to NDC with no significant difference at 800mg/kg body weight it also shows significant difference compared to diabetic group (DC).

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