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Research Article

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Evaluation of lipogenic property of *Phragmanthera capitata* in diabetic rats

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ABSTRACT

Objective: *Phragmanthera capitata* is a parasitic plant employed in the treatment of wide range of disorders in Cameroon folkloric medicine. The present study was carried out to evaluate lipogenic property of aqueous extract of the whole plant in alloxan-induced diabetic Wistar rats. **Materials and Methods:** Diabetic rats were grouped and treated as follows: Group I (control) received 10 ml/kg saline, Group II (standard) received 600 µg/kg glibenclamide and Groups III-V (tests) received 200, 400 and 800 mg/kg aqueous extract of *P. capitata* (AEPC) respectively for 15 days. Body weights of animals were recorded and blood glucose levels were assessed from tail prick in the course of the experiment. At the end of the experimental period, the animals were sacrificed and blood was collected via cardiac puncture for lipid profiling. **Results:** Body weight revealed a significant ($P \leq 0.05$) increase except for the group treated with 400 mg/kg extract as compared to control group. Treatment with extract did not result in any significant change ($P \geq 0.05$) in blood glucose level at all extract concentrations. However, the extract at 200 mg/kg significantly ($P \leq 0.05$) reduced total cholesterol (TC), triglyceride (TG), low density lipoprotein (LDL), non-high density lipoprotein (non-HDL) cholesterol levels, LDL/HDL ratio and significantly increased high density lipoprotein (HDL) cholesterol levels. **Conclusion:** Considering that lipogenesis encompasses both fatty acid and triglyceride synthesis, *P. capitata* aqueous extract at 200 mg/kg acted as anti-lipogenic agent. The extract also potentiated weight gain but exhibited non-significant ($P \geq 0.05$) effect on blood glucose concentrations at the dose levels used.

Keywords: *Phragmanthera capitata*, Anti-lipogenic, Diabetes, Loranthecaeae.

INTRODUCTION

In the United States, coronary heart disease (CHD) is the most common cause of death between women and men and accounts for about 500,000 deaths per annum [1]. The major risk factor for CHD is dyslipidemia which is abnormal amount of lipids like cholesterol and/or fat in the blood. In developed countries, majority of dyslipidemias are hyperlipidemias which is a heterogeneous group of disorders characterized by elevated level of lipids in the bloodstream caused by diet, lifestyle and prolonged rise of insulin levels [2]. These lipids include cholesterol, cholesterol esters, phospholipids and triglycerides. Atherosclerosis is one of the usual end results of hyperlipidemias with hardening and narrowing of arteries causing heart attacks, stroke and peripheral vascular diseases [3]. The new guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults makes use of statin therapy in secondary and primary prevention populations [4]. Considering that statin side effects include headache, drowsiness, dizziness, nausea or vomiting, diarrhea, constipation, high blood sugar and type 2 diabetes [5,6], it is plausible to search for plant based remedies that may not have these side effects.

Phragmanthera capitata is a member of loranthaceae family [7] of mistletoe with woody shrub and pendent branches of up to 2 m long. It is found in secondary jungle and bush savanna areas from Sierra Leone to Cameroons, Equatorial Guinea and extending across the Congo basin to Democratic Republic of Congo and Angola [8].

Aqueous extract of *P. capitata* has been scientifically reported to possess anti-diarrheogenic properties [9]; anti-secretory, gastroprotective and anti-ulcer activities [10]; anti-pyretic and analgesic potentials [11]; steroidogenetic and spermatogenetic activities [12]; antibacterial activities [13]; non-significant stress protection [14]; anxiety-lowering potential [15] and haematopoietic activity [16]. Leaves infusion is used to treat chlamydia infection, cancer, arthritis, epilepsy, gynecological problems and cardiovascular diseases in Cameroon folkloric medicine [17,18]. Therefore, our goal was to evaluate lipogenic property of the plant extract to find out if there could be any adverse effects that might predispose patients to cardiovascular diseases using Wistar rats.

MATERIALS AND METHODS

Plant material and preparation of extract

The parasitic plant, *Phragmanthera capitata* or Ntsalar, as it is known and called in Babadjou vernacular, was harvested from avocado trees in Konka, Baligham village in North Western Region of Cameroon in January 2014. Authentication of the plant and preparation of the extract were as described previously [9].

Subjects

Healthy Wistar rats of both sex and weighing between 100-150 g were housed in polyvinyl cages and maintained under standard laboratory conditions of relative humidity (50±5%), temperature (28±2^{0}C) and 12 h light/12 h dark photoperiod. The animals received standard pellet diet (Agro Feeds, Calabar) and water *ad libitum* and were treated according to Guide for the Care and Use of Laboratory Animals [19] and approved by Faculty of Basic Medical Sciences Ethical Committee.

Chemicals

Alloxan monohydrate and glibernclamide were purchased from Simal Aldrich, USA; Normal saline was bought from local pharmacy produced by Hunan FE Pharmaceutical Machinery Co., Ltd, China.

Experimental procedure

Alloxan monohydrate was dissolved in normal saline and injected (150 mg/kg) intraperitoneally. After four days, rats with about 100% induced diabetes were selected and used for the experiment. They were randomized into five groups: Group I (control) received 10 ml/kg saline, Group II (standard) received 600 µg/kg glibenclamide and Groups III-V (tests) received 200, 400 and 800 mg/kg AEPC respectively per oral per day for 15 days. Body weights of animals were recorded at 5 days interval while blood glucose level was assessed every 4 days from tail prick using one touch glucometer ((Fine test Auto-coding^{TM} Premium, Infopia, Korea). At the end of the experimental period, the animals were sacrificed by an overdose of chloroform anaethesia and blood was collected via cardiac puncture for lipid profiling [20].

Phytochemical and Acute toxicity tests

Preliminary phytochemical analysis of bioactive agents in the extract and acute toxicity tests were as previously described [9].

Statistical analysis

Data was analyzed by one-way analysis of variance (ANOVA) proceeded by Newman-Keuls multiple range test as post hoc. Each value represented the Mean ± SEM. P <0.05 was fixed at the designed stage of the experiment [21].

RESULTS

The effect of aqueous extract of *Phragmanthera capitata* on body weight of diabetic Wistar rats is shown in Fig. 1. Groups II, III and V showed significant (P ≤0.05) weight gain as compared to control group.

The effect of aqueous extract of *Phragmanthera capitata* on blood glucose level of Wistar rats is shown in Fig. 2. Significant (P ≤0.05) reduction in blood glucose was only observed in the standard group treated with 600 µg of glibenclamide after 8 days of treatment as compared to control group. The extract at all concentrations (200, 400 and 800 mg/kg) had non-significant (P ≥0.05) change on glucose level.

The effect AEPC on some lipid profile parameters is shown in Fig. 3. Group II (standard) treated with 600 µg/kg glibenclamide showed significant (P <0.05) increase in TC and HDL as compared to control group. Group III treated with 200 mg/kg AEPC showed significant (P ≤0.05) reduction in TC, TG, LDL, non-HDL while HDL showed a significant (P ≤0.05) increase as compared to control group. Group IV treated with 400 mg/kg AEPC showed significant (P ≤0.05) decrease in TC, TG, LDL, and non-HDL. Group V treated with 800 mg/kg extract showed significant (P ≤0.05) decrease in TC.

The effect of AEPC on LDL and HDL ratio is shown in Fig. 4.

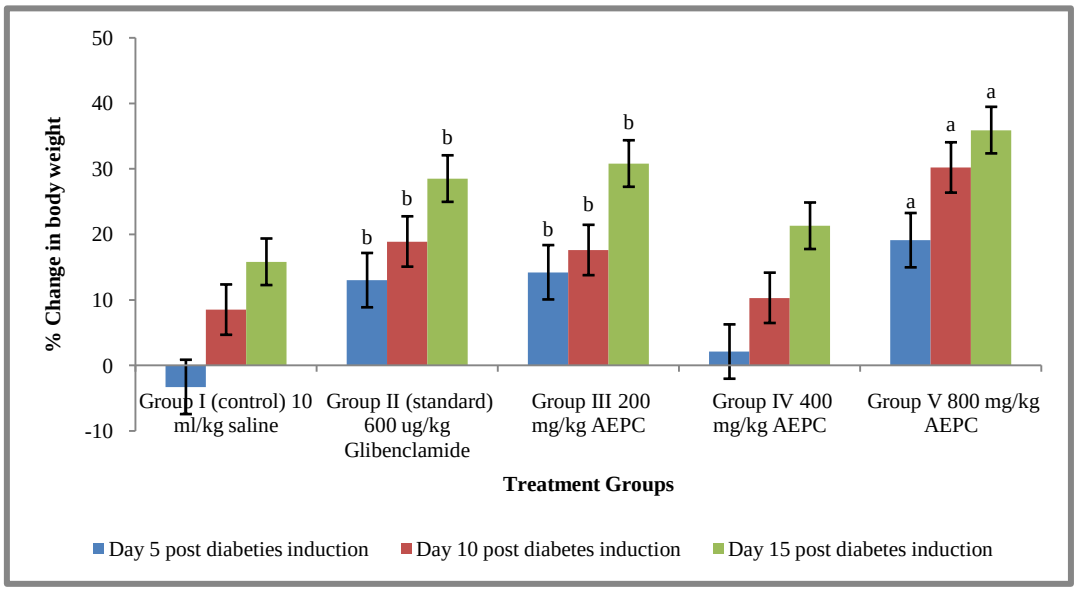

Figure 1: Effect of AEPC on weight of diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, p < 0.05)

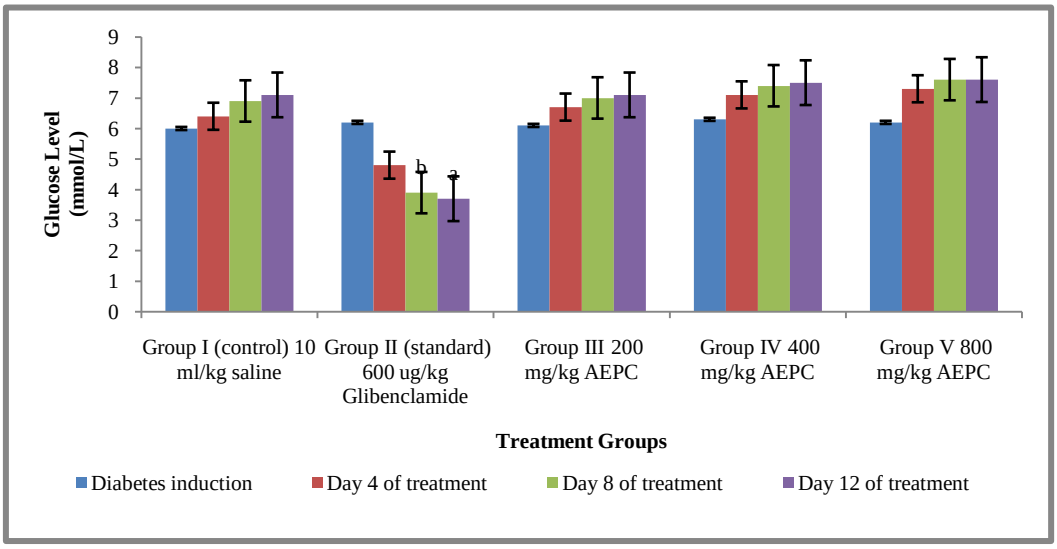

Figure 2: Effect of AEPC on blood glucose level in diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, $p < 0.05$)

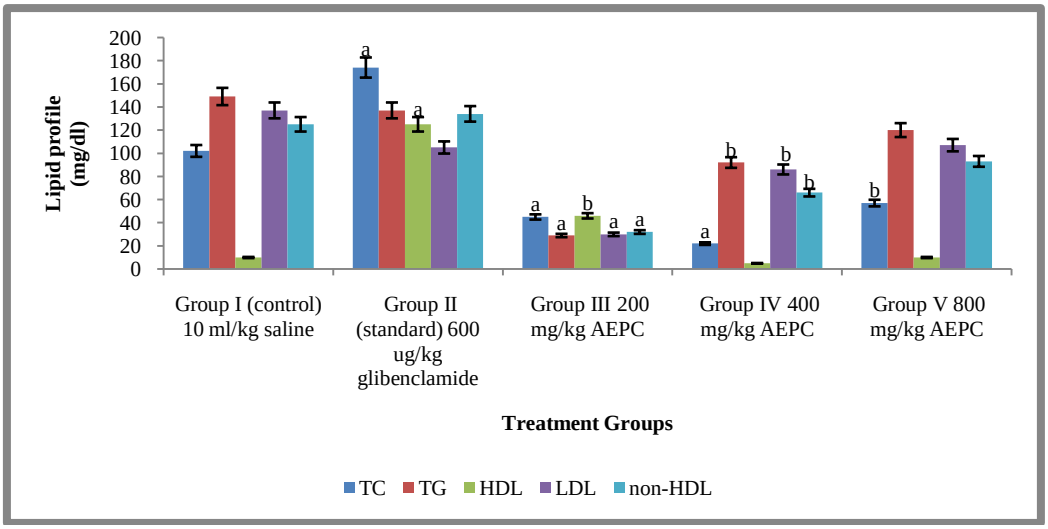

Figure 3: Effect of AEPC on lipid profile of diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, $p < 0.05$)

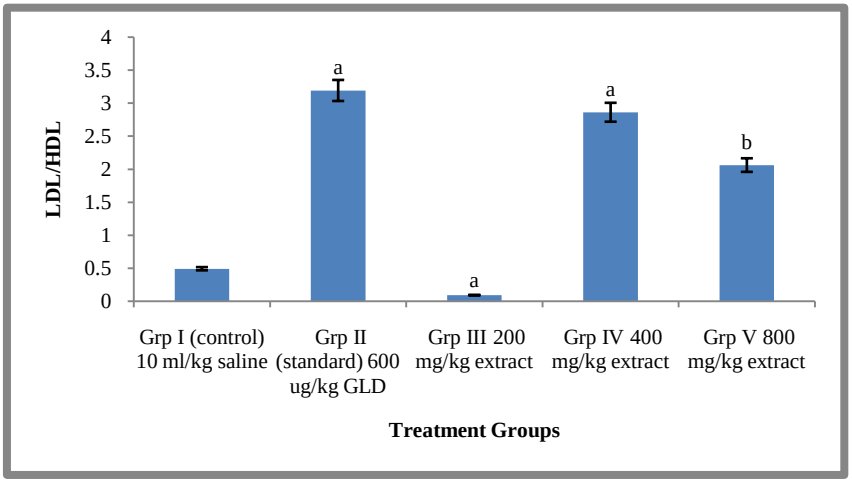

Figure 4: Effect of AEPC on LDL and HDL ratio in diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, $p < 0.05$)

DISCUSSION

Alloxan is a diabetogenic agent that acts by formation of superoxide radicals which dismutate to hydrogen peroxide eventually forming reactive hydroxyl radicals by the Fenton reaction [22]. Reactive oxygen species action coupled with simultaneous massive increase in cytosolic calcium concentration cause rapid destruction of beta cells in the pancreas. In the present study, administration of alloxan monohydrate caused a rapid rise in glucose concentration after four days of single intraperitoneal dose.

Glibenclamide that was used as standard drug is known to act by binding to and activating ATP-sensitive potassium channels inhibitory regulatory subunit sulfonylurea receptor 1 (SUR1) [23] in pancreatic beta cells. This inhibition leads to cell membrane depolarization and opening of voltage-dependent calcium channels resulting in an increased intracellular calcium in the beta cell and subsequent stimulation of insulin release. In the present study, glibenclamide showed a significant reduction of blood glucose level while the extract did not potentiate insulin release and therefore showed no significant change as compared to control group.

Increased weight of animals in the course of the experiment except the group treated with 400 mg/kg suggests that extract potentiate orexigenic activity (appetite enhancement) which has been reported of insulin too since glibenclamide causes rise in insulin level [24].

Fatty acids are synthesized mostly in the cytoplasm of hypatocytes and adipocytes from acetyl-CoA and build up by the addition of two-carbon units with the aid of fatty acid synthetase in a process called lipogenesis with subsequent esterification with glycerol to yield triglycerides [25]. In the present study, aqueous extract of *P. capitata* has significantly lowered TC, TG, LDL cholesterol, LDL/HDL cholesterol ratio suggesting that the extract might act through inhibition of fatty acid synthetase.

CONCLUSION

Aqueous extract of *Phragmanthera capitata* possesses anti-lipogenic activity but non-significant hyperglycaemic effect and should not be used in treating diabetic patients with other ailment treatable by the plant extract. Weight gain should not be misconstrued with obesity because at times it is beneficial, especially when a patient is suffering from severe appetite loss or muscle wasting due to cystic fibrosis, anorexia, cancer or AIDS. The cholesterol lowering effect of P. capitata indicates that this plant is a possible candidate from which anti-lipogenic drugs may be synthesized from.

Competing interest

Authors declare that there is no conflict of interest regarding the publication of this article.

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