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Assessment of Glycaemic Property of *Phragmanthera capitata*

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ABSTRACT

Medicinal plants in Cameroon, as is the case worldwide, has gained scientific interest because of the lead role they play in drug development. *Phragmanthera capitata* is a parasitic plant of both cultivable and non-cultivable plants employed in the treatment of wide range of disorders in Cameroon. The present study was aimed at assessing glycaemic property of aqueous extract of *P. capitata* (AEPC) whole plant in normal and alloxan-induced diabetic rat models. In both models, the rats were randomized into 5 groups of 6 rats each. In normal rat model, 200, 400 and 800 mg/kg extracts were used while 10 ml/kg and 600 µg/kg of saline and glibenclamide were respectively used as control and standard. In diabetic rat model, diabetes was induced by 150 mg/kg of alloxan. Treatment was the same as in normal rat model but lasted for 15 days. In normal rat model, the result revealed that 30 min post glucose load of 2 g/kg, glucose level had increased significantly ($P \leq 0.05$) as compared to control. In diabetic rat model, the extract showed no significant change in glucose level as compared to control. Body weight of animals showed significant increase ($P \leq 0.05$) in groups treated with 400 and 800 mg/kg extract. It can, therefore, be validly concluded that AEPC potentiates both gastrointestinal glucose absorption and weight gain in Wistar rats. Since the infusion/decoction of this plant is used in treating a variety of ailments in Cameroon folk medicine, it should not be given to diabetic patients who have other complications treatable by the plant extract.

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder of carbohydrate, fat and protein caused by different factors and characterized by a chronic high level of blood sugar because of defects in insulin secretion, insulin action, or both (1). DM is divided into four types: Type 1 which is insulin-dependent or juvenile onset diabetes; Type 2 which is insulin-resistant or adult onset diabetes; Type 3 is gestational diabetes or glucose intolerance with onset during pregnancy and Type 4 is tropical diabetes [2, 3]. However, tropical DM accounts for less than 1% of the diabetes cases in Africa and is thought to be related to malnutrition [4]. Diabetes complications include hypertension, high blood lipids and physical inactivity [5, 6], diabetic retinopathy which is leading cause of adult blindness, cataract and glaucoma [7], lower extremity amputation which is the major debilitating complication [7-9]. Gastrointestinal-related complaints include dysphagia, early satiety, reflux, abdominal pain, constipation, nausea, diarrhea and vomiting [10].

The incidence of diabetes, especially type 2, which may currently consider an epidemic, is increasing worldwide. Recent research shows one in 10 of the world's population will have diabetes by 2035. International Diabetic Federation (IDF) puts the startling figure at about 382 million people having diabetes in 2013 and 175 million people are currently undiagnosed and progressing toward complications unaware [11]. Diabetes imposes unacceptably high human, social and economic costs on countries of all income levels.

Drug used to treating diabetes may work by stimulating the pancreas to produce and release more insulin, inhibiting the production and release of glucose from the liver, blocking the action of stomach enzymes that break down carbohydrates or improving the sensitivity of cells to insulin. However, increases in diabetic incidence year in year out undoubtedly suggest that these drugs are not in all cases effective or are unavailable or expensive. The use of indigenous plants for medicinal purposes is very commonplace and widespread in the world. Herbal drugs are regarded to have a relatively higher therapeutic window, fewer side-effects and are economic than synthetic drugs [12] thereby advocating for research into phytoactive anti-diabetic agents.

Phragmanthera capitata is mistletoe belonging to the Loranthaceae family [13] with woody shrub having stems up to 2 m long. It is found in the secondary jungle and bush savanna areas of

Sierra Leone to Cameroons and Equatorial Guinea and extending across the Congo basin to Democratic Republic of Congo and Angola [14]. The plant is variable in form, common, widely distributed and often seen with ants' nests. Aqueous extract of *P. capitata* is documented to have anti-diarrheogenic properties [15]; anti-secretory, gastroprotective and anti-ulcer activities [16]; anti-pyretic and analgesic potentials [17]; steroidogenetic and spermatogenetic activities [18]; antibacterial activities [19]; non-significant stress protection [20]; anxiety-lowering potential [21] and haematopoietic activity [22]. Infusion/decoction of leaves and stem bark treats diabetes, chlamydia infection, dysentery, cancer, arthritis, epilepsy, fontanel and hypertension in Cameroon folkloric medicine [23, 24]. Our objective was to access glycaemic property of *P. capitata* in normal and diabetic induced 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 [15].

Animals

Healthy Wistar rats of both sexes 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 [25].

Experimental procedure

Normal rats

Animals were randomized into 5 groups and fasted for 16 h. Group I (control) received 10 ml/kg saline; Group II (standard) received 600 µg/kg glibenclamide (Euglucon N, Sanofi-Aventis,

Germany), Groups III-V (tests) received 200, 400 and 800 mg/kg AEPC respectively from acute toxicity study. Treatment was per oral and 30 min post administration, 2 g/kg of glucose load was administered to all the groups. Blood samples were collected by tail prick 0, 30, 60, 90, 120 min and blood glucose level was measured using automatic one touch glucometer (AccuChek Advantage II) [26].

Diabetic rats

Alloxan monohydrate (Sigma Aldrich, USA) was dissolved in normal saline and injected (150 mg/kg) intraperitoneally. After four days, rats with 100% 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, Groups III-V (tests) received 200, 400 and 800 mg/kg AEPC respectively per oral per day for 15 days. Body weight and blood glucose were measured throughout the course of the experiment.

RESULTS

Normal rats

The effect of AEPC on blood glucose of normal rats loaded with 2 g/kg glucose is shown in Fig. 2. At 30 min post glucose load, there were significant (P <0.05) rise in blood glucose of the groups treated with saline, 400 and 800 mg/kg extract. From 60 min onwards, the blood glucose level was more or less normalized.

Body weight

The effect of aqueous extract of *Phragmanthera capitata* on body weight of diabetic rats is shown in Fig. 2. Groups II, III and V showed significant ($P \leq 0.05$) weight gain as compared to control.

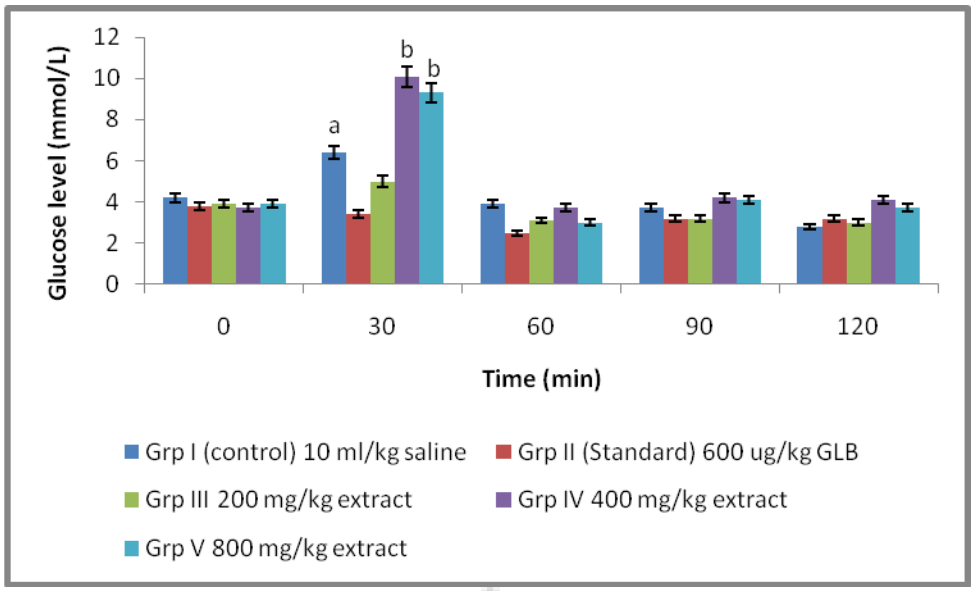

Fig. 1: Effect of AEPC on postprandial glycaemic level in normal Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, *P* ≤0.05)

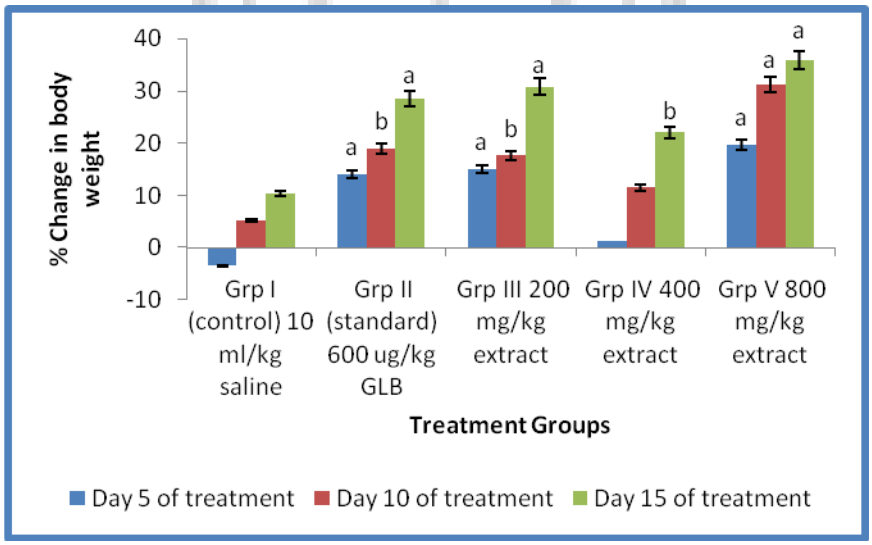

Fig. 2: Effect of AEPC on weight of diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, *P* ≤0.05)

Diabetic rats

The effect of aqueous extract of *Phragmanthera capitata* on blood glucose level of diabetic Wistar rats is shown in Fig. 3. Significant ($P \leq 0.05$) 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 ($P \geq 0.05$) change on glucose level.

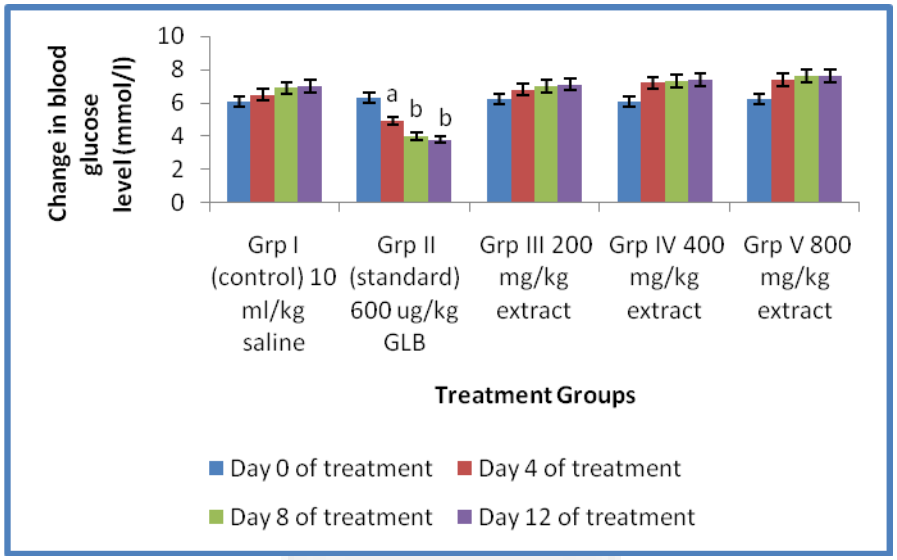

Fig. 3: Effect of AEPC on glycaemic level in diabetic Wistar rats. Each value is the mean ± SE for 6 rats. Values with different letters (a, b) are significantly different from one another (one-way ANOVA followed by Newman-Keuls pos-hoc test, $P \leq 0.05$)

DISCUSSION

In this study, postprandial glycaemic level was assessed because recent studies have attributed poor control to enhancement in cardiovascular disease development [27]. More recently, postprandial state is reported to be an important contributing factor to atherosclerosis development [28]. AEPC increased postprandial glycaemic level in normal rats, suggesting that the risk of postprandial hyperglycaemic spikes which is thought to be relevant to pathophysiology of late diabetes complications would be enhanced when the extract is given to a diabetic patient.

It is known that absorption of glucose from intestinal lumen entails transportation of glucose across epithelium into the blood. The cotransfer of glucose with sodium from the lumen into enterocyte is driven by active extrusion of sodium at the basolateral membrane through Na^+/K^+-ATPase pump [29, 30] into enterocyte. As accumulation builds up in the cytosol, passive transfer of glucose out occurs across basolateral membrane through sodium-independent facilitative transporter GLUT2 [31]. In the present study, AEPC showed significant increase in blood glucose suggesting that the extract potentiates cotransfer of glucose with sodium from intestinal lumen into enterocytes and blood capillaries.

Increased weight of animals in the course of the experiment suggests that AEPC potentiates orexigenic activity (appetite enhancement) which has been reported too of insulin since glibenclamide causes rise in insulin level [23]. Increased appetite leads to eating much food and drinking much water and these parameters were observed in the experimental groups.

In the assessment of blood glucose level in diabetic rats, it was observed that AEPC had no effect in lowering glucose level. This means that the extract could neither stimulating the pancreas to produce and release more insulin, inhibit the production and release of glucose from the liver, block the action of stomach enzymes that break down carbohydrates nor improve the sensitivity of cells to insulin.

CONCLUSION

It can, therefore, be validly concluded that AEPC potentiates gastrointestinal glucose absorption and potentiates weight gain in Wistar rats. Since the infusion/decoction of this plant is used in treating a variety of ailments in Cameroon folk medicine, it should not be given to diabetic patients who have other complications treatable by the plant extract.

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