ANTIDIABETIC ACTIVITY OF SOME HERBAL DRUG PREPARATIONS USED BY KENYAN HERBALISTS

P. G. Kareru[1], J. M. Karanja[2], F. K. Njonge[3], A. N. Gachanja[4] and D. Kimani[5]

[1,2,4,5]*Department of Chemistry, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*
[3]*Department of Animal Science, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*
E-mail: pgkareru@yahoo.com

Abstract
Diabetes is a condition characterized by high blood sugar levels in the human body due to lack of insulin or its insufficient production in the body. Its causes are genetics (Type 1) and inactivity (Type 2). In Kenya, over two million people have diabetes, with more susceptibility to urban people due to the erosion of traditional living and eating habits. The side effects of the conventional diabetes drugs are known but herbal drugs offer a suitable alternative. Four herbal drug preparations used by herbalists from Eastern Province, Kenya, were tested for their *in vivo* anti-diabetic activity in alloxan induced diabetes in *Swiss albino* rats. Glucose was administered to the rats orally and the blood glucose levels measured after 30 minutes. Herbal drug extracts were then administered and blood glucose levels monitored in intervals of 45 minutes for a period of 3 hours. The most active herbal drug preparation lowered blood glucose level from the peak 190.8 ± 7.0 mg/dl to 111.0. ± 8.5 mg/dl, while the conventional drug, Diamicron, lowered glucose levels from 190.8 ±7.5 mg/dl to 125.5 ± 2.1 mg/dl. These effects were found not to be significantly different (p > 0.05). Hence, herbal drug alternatives were effective.

Ke ywords: Diabetes, herbal drugs, blood sugar, *albino* rats

1.0   Introduction

There is a general increase in non communicable diseases in Kenya in the recent years. Of the most importance is diabetes which has been affected a big population due to lifestyle changes. There are two main types of diabetes mellitus both of which tend to run in families. Type 1 (insulin-dependent) diabetes is the less common form of disorder and usually develops in childhood or adolescence. In this type, insulin secreting cells in the pancreas are destroyed and insulin production ceases. Type 2 (non-insulin dependent) diabetes which is chronic and generally develops gradually mainly in people over the age of 40 (Adeneye *et al.*, 2009). Although insulin is still produced, there is not enough for the body's need as the tissues become relatively resistant to its effects (BMA, 2002 and Wadkar *et al.*, 2008). An ideal oral treatment and management of diabetes would be a drug that not only controls the glycemic level but also prevents the development of atherosclerosis and other complications of diabetes (Trivedi *et al.*, 2004).

Generally, diabetic patients suffer from a hyperglycemic condition whereby the concentration of sugar in their blood rises over the normal range of between 95-110 mmol/dL to values much higher than these. Treatment of diabetes entails injecting the patients with drugs that works towards enacting processes that tend to correct the sugar levels in the blood. In some rare cases, hypoglycemic condition arises in cases whereby production of insulin is excess hence all sugar reserves are converted to other forms of energy lowering the general sugar levels in their bodies.

The use of plants for the management of diabetes has been documented in a lot of literature and herbal drugs from various formulations have been made for the management of the disease. This formulation have are very popular in rural areas (Rahmatullah *et al.*, 2009 and Sani *et al.*, 2009). However the use of these drugs lacks accuracy and certainty since not enough research has been done to ascertain the efficiency, dosage, safety, side effects posed by these drugs or other parameters that are used to determine whether a given drug meets the standard pharmacological standards (Kareru, 2008). Qualifications of the medicine-men or other individuals who administered the drugs were also bound to be questionable since there was no formal training given to them concerning the various drugs, how to prescribe, dosage, and how to counter side effects in case they occur. Research is therefore necessary to make the herbal drug use towards controlling this disease more accurate, certain and safe.

2.0   Methodology
2.1   Collection and Preparation of Plant Material
Dry powdered samples were obtained from commercial herbalists in Mbeere. Ethanol was used as extraction agents of the dry herbal drugs. The solution was then pre-concentrated and the solvent was liberated using a rotary evaporator at 50 °C. The extract was the kept in a refrigerator at < 4 °C for the further use.

2.2   Experimental Animals
The study comprised of animals of both sexes males and females of eight weeks old obtained from JKUAT animal rearing unit. The animals were allowed to acclimatize to the environment for five days. The animals were given standard laboratory diet ad libitum unless during the test but water was given throughout the experiment. Light was availed to the animals 24 hours daily.

2.3   Experimental Design
Rats were divided into two major groups according to the treatment.
Group A were treated with a placebo (2 ml distilled water each). This acted as a control group of rats not induced with diabetes.
Group B were treated with a diabetic inducing agent. In this experiment, alloxan was orally introduced into the rat bodies at least 48 hours before any treatment was administered on them. From this group the rats were further subdivided according to the treatment that was administered they were subsequently labeled C, D, E, F and G.
Group C rats were given 2ml of distilled water (placebo). They therefore acted as a control group for diabetic rats.
Group D rats were treated with a conventional diabetic drug where tablets of diamicron drug were crushed, weighed then dissolved in distilled water to prepare a standard solution to be given orally to the rats using a syringe. Groups E, F and G were treated with a herbal drug extracts.

A dose rate of 500 mg/kg of a herbal drug extract was administered orally to the rats, the solution of the extracts was prepared by dissolving 10 g of the plant extracts 250 ml of distilled water to prepare 40 g/L solution. Blood was withdrawn from the tail vein of the rats and Fasting blood glucose and the Oral tolerance glucose test was performed to the rats by glucose oxidation method by the use of a glucometer.

2.3   Statistical Analysis

The results obtained were expressed as means ± SEM. Significance test was carried out on the results using the students't-test. P value < 0.05 was considered to be significant and the results were compared to the positive and negative control (Swanston-Flatt *et al.*, 1990).

3.0   Results and Discussion

The results obtained were as shown below. The fasting blood glucose was found to range from 56.75 ± 5.2 mg/ dL and 65.5 ± 7.51 mg/ dL (Table 1). The oral glucose tolerance test was performed and after 45 minutes the blood glucose levels were found to increase to range 171.5 ± 4.95 mg/ dL to 192.5 ± 12.02 mg/ dL (Table 1). This was a confirmation that diabetes was induced. (Rahmatullah *et al.*, 2009; Sani *et al.*, 2009; Trivedi *et al.*, 2004).

Table 1: A table of showing the level of blood glucose on administration of various herbal extracts against the control

Group (n = 4)	Treatment	Glucose conc. At t = 0	Initial conc. At t = 35	After 45 min At t = 80	After 90 min At t = 125	After 135 min At t = 170	After 180 min At t = 215
A	HC	61.5 ± 0.6	108.5 ± 7.5	163.0 ± 2.3	151.0 ± 10.4	134.5 ± 0.1	118.5 ± 0.7
B	NC	65.5 ± 7.51	99.5 ± 1.7	181.5 ± 5.2	170.5 ± 1.7	149.0 ± 1.2	138.0 ± 0.6
C	PC	56.8 ± 5.2	103.5 ± 5.7	190.8 ± 7.5	168.8 ± 3.1	136.3 ± 4.7	125.5 ± 2.1
D	P	62.0 ± 2.8	97.0 ± 9.9	192.5± 12.0	171.0 ± 2.8	143.0 ± 2.8	131.5 ± 2.1
E	Q	61.0 ± 2.8	104.0 ± 8.5	179.5 ± 2.1	151.5± 3.5	126.5 ± 0.7	112.0 ± 4.2
F	R	64.0 ± 8.5	110.0 ± 4.2	171.5 ± 5.0	156.0 ± 2.1	130.0 ± 4.2	111.5 ± 9.2
G	S	58.5 ± 3.5	110.0 ± 1.4	190.0 ± 4.2	158.0 ± 4.24	137.0 ± 2.8	111.0 ± 8.5

HC control group rats not induced with diabetes, NC control group of rats induced with diabetes, PC positive control of rats induced with diabets. P, Q, R and S were the herbal drug preparations.

The glucose tolerance tests for the various herbal preparations including controls was presented below (Figures 1 and 2). As shown in the graphs, the blood sugar levels were found to peak and stabilize to level lower than 138.0 ± 0.6 which was shown by the negative control of the rats induced with diabetes.   .
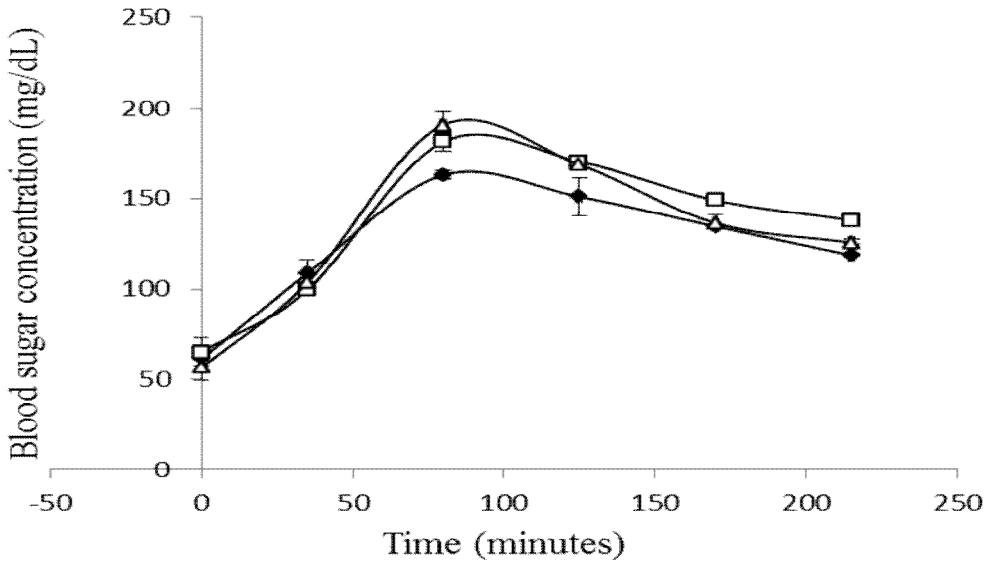
Figure 1: A graph showing the increase of blood sugar in rats after administration of glucose in positive and negative controls for rats induced with diabetes and the control group of rats not iduced with diabetes

—☐— negative control for rats induced with diabetes.

—△— positive control for rats induced with diabetes.
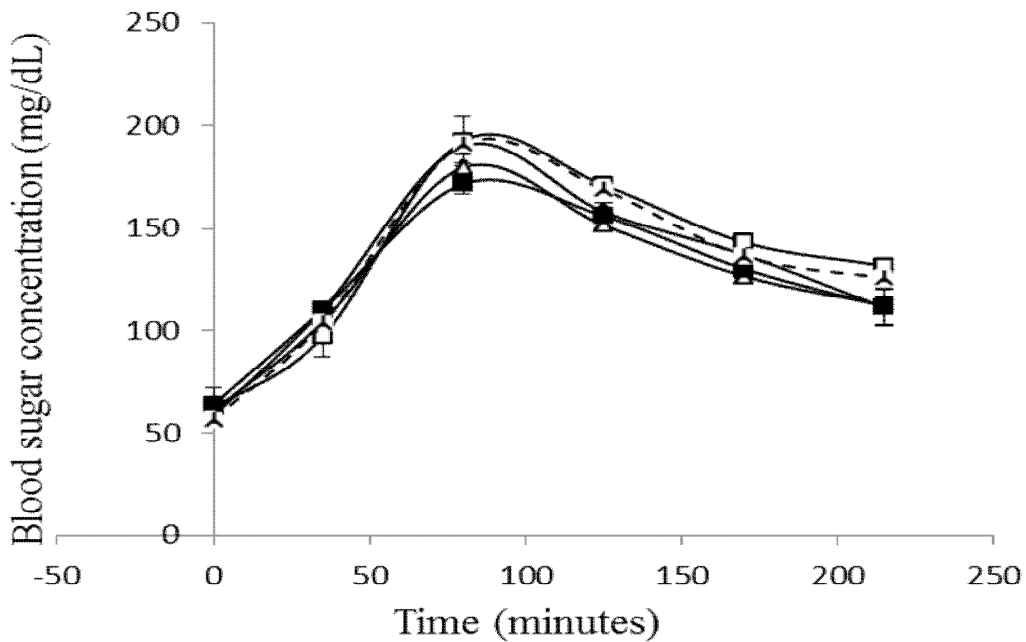
—◆— control for rats not induced with diabetes.

Figure 2: Graph showing the activity of various herbal drug preparations compared with the positive control.
—◆— drug S. —☐— drug P. —△— drug Q. —■— drug R. - -✕- - positive control.

The peak levels of the blood sugar concentration were found after 80 minutes of administration of glucose (fig 1and fig 2). This was 45 minutes after administration of the herbal drugs and this trend was observed in all extracts which were administered (fig 2). However, all the herbal drug extracts were found to decrease the concentration of glucose 3 hours after. The increase in the blood glucose corresponded 80 minutes to the administration of glucose to the animal which was found to be higher for in the rats that were induced with diabetes. Sample S (fig 2), was found to be the most active in lowering the blood sugar which was comparable to the control. Decrease of the blood sugar levels showed the activity of the four herbal extracts and indicates the potential of plant drugs for the treatment of diabetes.

Alloxan drug has been used for along time to induce non insulin dependent diabetes mellitus (NIDDM) in Rats and its mechanism has also been studied (Wadkar *et al.*, 2008). Alloxan is known to be selective against β cells of the pancreatic islet of the Langerhans which are known processes the insulin in the body. It is known to destroy these cells. It causes degranulation, hydropic degeneration and clumping of the cells and necrosis of these cells is observed (Singh *et al.*, 2007 and Trivedi *et al.*, 2004). The destruction of insulin secreting β- cells of the pancreas by alloxan, results in decreased endogenous insulin release (Ene *et al.*, 2010). When glucose is therefore, administered to Alloxan induced diabetic rats they became hyperglycaemic in a short period of time, followed by hepatic glucose overproduction.

Diabetes is a condition in which the blood sugar rises to high levels some times uncontrollable and there in no single particular cause. The indicator is in the rise of the blood sugar levels. Various complications arise from glycosylation therefore, it is important to monitor this to control the complications (Zhou *et al.*, 2009). Various classes of phytochemicals that have been linked to lowering the blood sugar in the blood include alkaloids, Flavonoids and Tannins (Jain *et al.*, 2010 and Sani *et al.*, 2009). Alkaloids have been linked to the regeneration of the B cells of the pancreas (Singh *et al.*, 2007). Flavonoids and tannins are known for their antioxidant properties and anti diabetic activities (Rahmatullah *et al.*, 2009).

Conclusion
Herbal drugs had a level of efficacy that could be applied in practical situations. This was demonstrated by the drug's ability to normalize the levels of sugars at an appreciable rate in both healthy diabetic rats.

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