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Anti-diabetic Activity in Mice of *Piper Capence* Used Traditionally in the Management of Diabetes Mellitus in Kenya

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Abstract

Diabetes mellitus causes significant morbidity, mortality, and diabetes related complications. Conventional drugs are used in management of diabetes mellitus but are costly, are not readily available and also have many side effects. Herbal plants used in diabetes mellitus management are believed to be cheaper and readily available. *Piper capense* is used traditionally in diabetes mellitus management but its efficacy has to be scientifically evaluated. The study's aim was to investigate antidiabetic potential of aqueous root extracts of *Piper capense* in diabetic male albino mice. The antidiabetic potential of the extracts was screened in diabetic mice using oral as well as intraperitoneal routes. In the study, albino mice were put into eight groups comprising five mice each. For this purpose aqueous extract was administered at 25, 48.4, 93.5, 180.9, and 350 mg/kg body weight. 1IU/kg body weight dose of insulin and 4.6 mg of glibenclamide was used as a standard hypoglycemic agent for comparing the results. Blood sugar levels were measured at 2, 4, 6, 8, 10 and 24 hours with the use of a glucometer. The data was then analyzed using ANOVA and post-ANOVA. The lyophilate of *Piper capense* phytochemical composition was determined by standard procedures. *Piper capense* extracts administered by either route at 25 mg/kg body weight, 48.4 mg/kg body weight, 93.5 mg/kg body weight, 180.9 mg/kg body weight and 350 mg/kg body weight showed antidiabetic activity. The phytochemical result showed that the aqueous extracts contained tannins, flavonoids, alkaloids, sterols, and saponins. The antidiabetic activity showed could be due to the presence of some phytochemicals present which have antidiabetic activity.

Keywords: Diabetes mellitus; Hypoglycemic activity; *Piper capense*; *in vivo*; Antidiabetic activity; IU (Insulin units); Glibenclamide

Introduction

Diabetes mellitus has many causes and is characterized by high blood sugar level. The observed hyperglycemia is due to interferance in metabolism of protein, carbohydrate and fat due to impaired secretion and action of insulin [1]. Diabetes mellitus is characterized by excessive blood glucose due to insufficient insulin production in the pancreas or by the inability of the produced insulin to control blood glucose [2]. Hyperglycemia leads to severe consequences such as amputations, brain damage and diseases of the heart [3]. About 171 million people worldwide had diabetes in 2000 and this is expected to increase to 366 million people by the year 2030 [4].

Diabetes is diagnosed clinically by the presence of polyuria, weight loss and polydipsia. Diabetes mellitus is confirmed by abnormal blood glucose level [4]. Normally fasting plasma sugar levels range between 3.5-6.7 mmol/l. Fasting plasma glucose levels repeatedly at ≥ 7.0 mmol/L (126 mg/dl) confirms diabetes [5]. The treatment of DM is based on oral hypoglycemic agents and insulin injections. The hypoglycemic agents currently used in clinical practice have characteristic profiles of adverse side effects [6]. Diabetes mellitus management with insulin causes side effects such as such as resistance of insulin, atrophy of brain, anorexia nervosa, and fatty liver after a long time of treatment. Therefore, due to the side effects there is need to come up with effective, safe and readily availlable antidiabetic drugs. Medicinal plants can therefore provide the effective, safe and cheap drugs [7]. Plants contain many bioactive compounds and therefore they are a possible source of different types of drugs [8]. A number of traditional plants have been reported to have antidiabetic effect. For instance, *Pappea capensis* and *Pterocarpus marsupium* has long histories of use in treatment of diabetes mellitus [9]. *Ginkgo biloba* extract has proved useful for prevention and treatment of early-stage diabetic neuropathy [10].

Among the traditionally used plants in the diabetes mellitus management in Gilgil Nakuru county Kenya is *Piper capense*. The *Piper* genus is an important medicinal plant in the tropical region [11]. Volatile oil from *Piper capense* has been reported to show inhibitory effect of the tumor cells, antioxidant and antimicrobial activity [12]. However, there is limited scientific evidence regarding the antidiabetic efficacy profiles to back up the continued therapeutic application of this herbal remedy. This study provides the knowledge on the use of *Piper capense* in the diabetes mellitus management that will go a long way in validating its folkloric usage.

Material and Methods

Study site

This study site was at the Department of Biochemistry and Biotechnology, School of Pure and Applied Sciences, Kenyatta University in 2016.

Collection of plant materials

Collection of the roots of *Piper capense* was done in Gilgil division of Naivasha district in Nakuru County, Kenya. This collection was

guided on the information from practicing herbalists on antidiabetic activity of *Piper capense*. Identification of the plant was done at the at the National Museum of Kenya herbarium.

Processing of plant

The roots were cut into pieces which were air-dried under shed for one month. Dried materials were then ground into powder using of an electric mill. The powder was kept in plastic bags away from sunlight.

Preparation of aqueous plant extracts

A hundred grams powdered roots were extracted in 1 litre of water at 60°C for about 6 hours. The metabolic shaker was used for this extraction. Cooling of the mixture was natural and on cooling it was decanted over folded cotton gauze staffed in a funnel into a conical flask. Freeze drying of the filtrate was done for 72 hours. The concentrated extract was stored in an air tight sample bottle at -20°C.

Experimental animals

The Albino mice of 3-4 weeks old and weighing 22-27 g were used in the study. The mice were fed on rodent pellets and water ad libitum. Protocols and procedures of experiment were approved.

Induction of diabetic

During the experiment mice were fasted for at least 8-12 hours but were given water. Diabetes was induced by administration of 186.9 mg/kg weight of 10% alloxan monohydrate intraperitoneally. The control animals were administered normal saline intrperitonially. At 48 hours after induction of diabetes blood sugar level was measured with a glucometer. Only those mice which were considered diabetic (blood glucose >2000 mg/L or >11.1 mmol per litre) were included for this study.

Experimental design

Eight groups of five animals each were used as labelled below:

Group I - Normal mice administered intraperitoneally or orally with 0.1 ml physiological saline.

Group II - Alloxan induced diabetic animals administered intraperitoneally or orally with 0.1 ml physiological saline.

Group IIIa - Alloxan induced diabetic animals administered inntraperitoneally with 0.12 units of insulin in 0.1 ml physiological saline.

Group IIIb - Alloxan induced diabetic mice orally administered with 4.6 mg of glibenclamide (200 mg/kg body weight) in 0.1 ml physiological saline.

Group IV - Alloxan induced diabetic animals administered intraperitoneally or orally with 0.575 mg extract in 0.1 ml physiological saline (25 mg/kg body weight).

Group V - Alloxan induced diabetic animals administered intraperitoneally or orally with 1.11 mg extract in 0.1 ml physiological saline (48.4 mg/kg body weight).

Group VI - Alloxan induced diabetic animals administered intraperitoneally or orally with 2.15 mg extract in 0.1 ml physiological saline (93.5 mg/kg body weight).

Group VII - Alloxan induced diabetic animals administered intraperitoneally or orally with 4.16 mg extract in 0.1 ml physiological saline (180.9 mg/kg body weight).

Group VII - Alloxan induced diabetic animals administered intraperitoneally or orally with 8.06 mg extract in 0.1 ml physiological saline (350 mg/kg body weight).

Blood sampling, blood glucose, rate constant and half-life determination

Samples of blood were obtained from the tail after sterilizing it with alcohol. The tail was nibbed and drops of blood squeezed into a glucometer. The samples were collected at the beginning of the experiment and repeated at intervals of 2, 4, 6, 8, 10 and 24 hours. Rate constant (k) was determined by a plot of log blood glucose concentration of first 4 hours against time (in hours). The plot gave pseudo-first order rate constant (k/2.303). The constant is indicated by the point where straight line intersects logarithm of blood sugar concentration axis (This showed the sugar concentration before administration of the drug) [13]. Calculation of the half-life was done by substituting constant (k) in formulae: $t_{0.5}$=0.693/k. Half-life refers to the time taken to reduce blood glucose level by half for a given dosage [14]. The equation of exponential decay was used to determine the dosage which would be given after a given period [15].

Screening of phytochemicals

Standard methods were used to determine the phytochemical of alkaloids, flavonoids, saponins, tannins, and sterols present in *Piper capense* extracts [16,17].

Management of data and statistical analysis

Data was put in Microsoft Excel and after cleaning exported to Statistical Package of Social Sciences (SPSS) software where analysis was done. Results were given as Mean ± SD (standard deviation) of number of mice used in a study group. Analysis was done with use of ANOVA and also post-ANOVA which compared the means of normal control animals with diabetic animals administered with saline, diabetic animal's adminisered with conventional drugs, diabetic animals administered with plant extracts at 25, 48.4, 93.5, 180.9, and 350 mg/ kg body weight. $P \leq 0.05$ was considered to be statistically significant.

Effects of oral and intraperitoneal administration of *Piper capense* extracts on blood glucose levels in alloxan induced diabetic mice

Administration by oral route of *Piper capense* aqueous extracts of at 25, 48.4, 93.5, 180.9, and 350 mg per kilogram body weight in mice decreased the blood sugar levels significantly from the 2nd hour through to the 8th hour without regard to the amount of dose given. The percentage reductions of blood sugar levels in mice by the aqueous root extract of *Piper capense* at the five dose levels (25, 48.4, 93.5, 180.9, and 350 mg per kilogram body weight) during the 2nd hour was 47.8%, 57.2%, 58.7%, 57.5% and 47.4%, respectively, compared to glibenclamide administered diabetic mice whose plasma glucose levels was decreased to 71.7% within the second hour (Figure 1). At the 2nd hour the plant root extract decreased the blood sugar levels but the attained levels were not normal ($^{d}\rho<0.05$) (Table 1). The doses,

however, significantly decreased blood sugar levels in comparison to diabetic control ($^{a}\rho<0.05$) (Table 1).

Treatment	Route	Glucose Levels at Varying Times (mm/L)					
		0 hr	2 hr	4 hr	6 hr	8 hr	24 hr
Group I	IP	5.26 ± 0.05	5.32 ± 0.06^{BFGH}	5.36 ± 0.05^{BDEFGH}	5.22 ± 0.37^{BDEFGH}	5.30 ± 0.04^{BDEFG}	5.32 ± 0.05^{BGH}
(Normal saline)	Oral	5.18 ± 0.04	5.18 ± 0.04^{efhi}	5.20 ± 0.03^{efghi}	5.16 ± 0.02^{befgh}	5.20 ± 0.03^{begh}	5.22 ± 0.04^{bghi}
Group II	IP	14.70 ± 1.08^{BDEFGH}	15.86 ± 1.13	17.14 ± 1.27	18.58 ± 1.34	20.18 ± 1.32	23.60 ± 1.54
(Diabetic)	Oral	13.42 ± 0.95^{befghi}	14.76 ± 0.76b	16.20 ± 0.65	17.34 ± 0.61	19.26 ± 0.62	21.66 ± 1.14
Group IIIa (Insulin)	IP	14.40 ± 0.67^{ADEFGH}	6.32 ± 0.27^{CEFGH}	5.94 ± 0.20C^{DEFGH}	5.42 ± 0.16^{CDEFGH}	5.10 ± 0.11^{CDEFG}	6.82 ± 0.20^{CEFGH}
Group IIIb (Glibenclamide)	Oral	15.60 ± 1.33^{aefghi}	11.18 ± 1.67^{agh}	8.10 ± 0.87h	6.38 ± 0.41deh	5.18 ± 0.12^{degh}	8.18 ± 0.83^{defghi}
Extract							
Group IV	IP	14.30 ± 0.69^{ABDEFGH}	10.06 ± 0.65^{DEFG}	7.72 ± 0.56^{BCDEFG}	6.42 ± 0.35^{BCDEFG}	5.36 ± 0.25^{BCDEFG}	10.70 ± 0.55^{DEFG}
(25 mg/kg)	Oral	13.86 ± 0.28^{abefghi}	6.62 ± 0.78^{defghi}	5.02 ± 0.36^{defghi}	4.50 ± 0.36^{bdefghi}	4.16 ± 0.35^{bdefghi}	9.82 ± 0.44^{befghi}
Group V	IP	14.58 ± 0.67^{ABDEFGH}	8.12 ± 0.45^{BDEFGH}	6.22 ± 0.46^{BCDEFGH}	5.08 ±0.32^{BCDEFGH}	4.10 ± 0.45^{BCDEFGH}	9.62 ± 0.47^{BDEFG}
(48.4 mg/kg)	Oral	11.88 ± 1.85^{abefghi}	6.80 ± 0.74^{defghi}	5.16 ± 0.62^{defghi}	3.96 ± 0.45^{defghi}	3.24 ± 0.31^{efghi}	9.40 ± 0.43^{befghi}
Group VI	IP	14.42 ± 0.47^{ABDEFGH}	8.00 ± 0.14^{BCDEFGH}	5.46 ± 0.43^{BCDEFGH}	4.40 ± 0.40^{BCDEFGH}	3.36 ± 0.20^{BCDEFGH}	8.68 ± 0.56^{BDEFGH}
(93.5 mg/kg)	Oral	13.38 ± 0.37^{abefghi}	7.86 ± 0.50^{bdefghi}	5.44 ± 0.53^{defghi}	4.40 ± 0.35^{defghi}	3.68 ± 0.34^{befghi}	8.38 ± 0.74^{bdefghi}
Group VII	IP	14.16 ± 0.61^{ABDEFGH}	7.32 ±0.51^{BCDEFGH}	5.16 ± 0.34^{BCDEFGH}	4.18 ±0.31^{BCDEFGH}	3.48 ± 0.21^{BCDEFGH}	8.54 ± 0.63^{BCDEFGH}
(180.9 mg/kg)	Oral	12.60 ± 0.72^{abefghi}	7.24 ± 0.67^{bdefghi}	5.56 ± 0.60^{bdefghi}	4.78 ± 0.58^{bdefghi}	4.14 ± 0.87^{bdefghi}	8.40 ± 0.81^{bdefghi}
Group VIII	IP	13.78 ± 0.74^{ABDEFGH}	6.70 ± 0.53^{BCEFGH}	4.38 ± 0.20^{BCEFGH}	3.46 ± 0.29^{BCEFGH}	2.56 ± 0.14^{EFGH}	5.54 ± 0.38^{BCFGH}
(350 mg/kg)	Oral	12.28 ± 0.55^{abefghi}	5.82 ± 1.08^{defghi}	3.70 ± 0.23^{defghi}	3.16 ± 0.28^{efghi}	2.66 ± 0.26^{efghi}	7.10 ± 0.57^{bdefghi}

Expression of the result was Means ± SD (Standard Deviation) for five mice in a group. Means followed by identical capital letters and identical small letters in the same column are not are not statistically different at $\rho \leq 0.05$ by ANOVA and post ANOVA (Bonferroni-Holm) test. Means for IP administration: $^{C}\rho<0.05$ with respect to control normal; $^{A}\rho<0.05$ with respect to diabetic control; $^{B}\rho<0.05$ with respect to insulin; $^{D}\rho<0.05$ with respect to 25 mg/kg; $^{E}\rho<0.05$ with respect to 48.4 mg/kg; $^{F}\rho<0.05$ with respect to 93.5 mg/kg; $^{G}\rho<0.05$ with respect to 180 mg/kg; $^{H}\rho<0.05$ with respect to 350 mg/kg. Means for Oral administration: $^{d}\rho<0.05$ with respect to normal control; $^{a}\rho<0.05$ with respect to diabetic control; $^{b}\rho < 0.05$ with respect to glibenclamide $^{e}\rho<0.05$ with respect to 25 mg/kg; $^{f}\rho<0.05$ with respect to 48.4 mg/kg; $^{g}\rho<0.05$ with respect to 93.5 mg/kg; $^{h}\rho<0.05$ with respect to 180 mg/kg; $^{i}\rho<0.05$ with respect to 350 mg/kg.

Table 1: Effects of five doses of aqueous root extracts of *Piper capense* with time on blood sugar levels in diabetic mice.

During the fourth hour, the sugar decreasing effect of five doses observed was 36.2%, 43.4%, 40.7% 44,1% and 30.1%, respectively, in comparison to glibenclamide administered diabetic mice whose plasma glucose levels was decreased to 51.1% within the fourth hour. The extract decreased plasma sugar levels to almost normal ($^{d}\rho>0.05$) and even to levels lower than those caused by glibenclamide ($^{b}\rho<0.05$). In the 6th hour, the root extract decreased plasma glucose levels by 32.5%, 33.3%, 32.9%, 37.9% and 25.7%, respectively in comparison to glibenclamide administered diabetic mice whose plasma glucose levels was decreased to 40.9%. At this hour 180.9 mg/kg extract decreased plasma sugar levels like glibenclamide ($^{b}\rho<0.05$). Same trend was shown in the eighth hour when the five doses decreased plasma sugar to levels below that of glibenclamide which decreased to 33.2%. The percentage plasma sugar decrease were 30.0%, 27.3%, 27.5%, 32.9% and 21.7%, respectively (Figure 1).

Administration intraperitoneally of aqueous root extracts of *Piper capense* at 25, 48.4, 93.5, 180.9, and 350 mg/kg body weight to mice significantly decreased the blood glucose levels from the 2nd hour through to the 8th hour in a dose independent manner. The percentage reductions of blood glucose levels in mice by the aqueous extract of *Piper capense* at the five dose levels (25, 48.4, 93.5, 180.9, and 350 mg/kg body weight) during the 2nd hour was 70.4%, 55.7%, 55.5%, 51.69% and 48.63%, respectively, comparison to insulin administered

diabetic mice whose plasma glucose levels was lowered to 43.89% within the second hour (Figure 2). The percentage reduction was however significant compared diabetic control group ($^{A}\rho<0.05$) (Table 1).

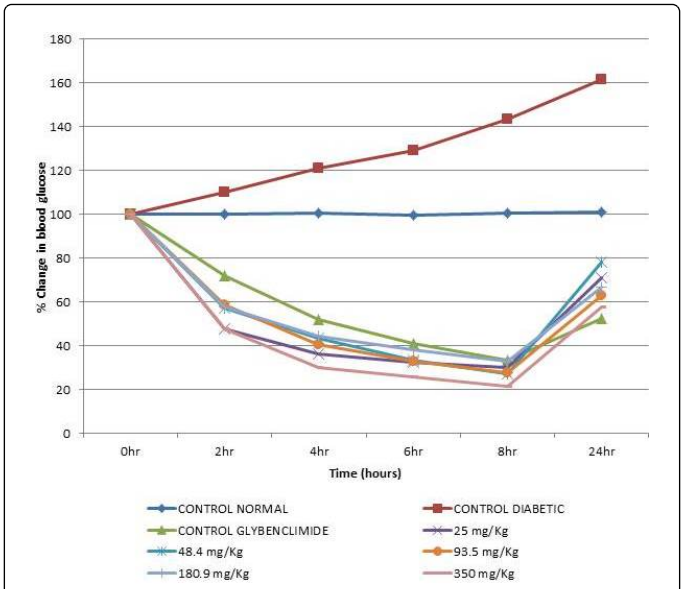

Figure 1: Percentage decrease in plasma sugar levels at different times after administration of plant root extracts of *Piper capense* orally at 25, 48.4, 93.5, 180.9, and 350 mg per kilogram body weight in diabetic male mice.

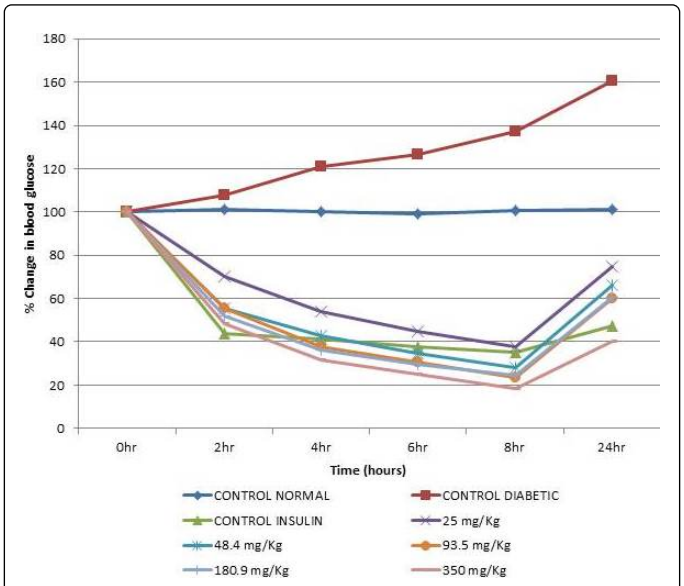

Figure 2: Percentage decrease in plasma sugar levels at different times after administration of plant root extracts of *Piper capense* intraperitoneally at 25, 48.4, 93.5, 180.9, and 350 mg per kilogram body weight in diabetic male mice.

During the 4th hour, the glucose lowering effect by the five dose levels was also observed; the reduction by percentages of plasma sugar levels were 54,0%, 42.7%, 37.9% 36.4% and 31.8%, respectively, comparison to insulin administered diabetic animals whose plasma glucose levels was decreased to 41.3% within the fourth hour. The extract lowered blood glucose levels to normal ($^{C}\rho>0.05$). In the 6th hour, the extract lowered blood glucose levels by 44.9%, 34.8%, 30.5%, 29.5% and 25.1%, respectively, in comparison to insulin administered diabetic mice whose plasma glucose levels was decreased to 37.64%. At this hour 48.4 mg/kg extract lowered blood glucose levels as effectively as insulin ($^{B}\rho<0.05$). Similar behaviour was observed during the eighth hour when the five dosages decreased plasma sugar level to levels below those of insulin which decreased glucose by 35.4%. The percentage blood glucose reductions were 37.5%, 28.1%, 23.3%, 24.6% and 18.6%, respectively (Figure 2).

Table 2 shows the pharmacokinetics of antidiabetic activity for the 1st 4 hours of root extracts of *Piper capense*. Pseudo-first order rate constants for the oral administration of root extract *Piper capense* at 25 mg/kg, 48.4 mg/kg, 93.5 mg/kg, 180.9 mg/kg and 350 mg/kg were 0.5078, 0.417, 0.45, 0.409 and 0.5998, respectively, and their accompanying half-lifes were 1.36, 1.66, 1.54, 1.69, and 1.16, respectively. The observed half-lifes were lower than those of glibenclamide.

Drug (dose)	Route	Rate constant (hour^{-1})	Half-life (hours)
Insulin	IP	0.4428	1.57
Glibenclamide	Oral	0.3277	2.11
Extract (mg per kilogram body weight)			
25	IP	0.3082	2.25
	Oral	0.5078	1.36
48.4	IP	0.417	1.66
	Oral	0.417	1.66
93.4	IP	0.4856	1.43
	Oral	0.45	1.54
180.9	IP	0.4783	1.45
	Oral	0.409	1.69
350	IP	0.5731	1.21
	Oral	0.5998	1.16
Expression of the results is Means of five animals for each time point			

Table 2: Pharmacokinetics of antidiabetic activity for the 1st 4 hours of the 5 doses of the aqueous root extracts of *Piper capense.*

Pseudo-first order rate constants for the intraperitoneal administration of doses of the aqueous root extracts of *Piper capense* at 25 mg/kg, 48.4 mg/kg, 93.5 mg/kg, 180.9 mg/kg and 350 mg/kg were 0.3082, 0.417, 0.4856, 0.4783 and 0.5731, respectively, and their accompanying half-lifes were 2.25, 1.66, 1.43, 1.45 and 1.21, respectively. The half-lifes of 25 mg/kg, and 48.4 mg/kg doses were higher than those of insulin while those of the other doses were lower. The rate constants for the orally administered aqueous extracts of *P. capense* for the five doses ranged from 0.409 to 0.5998 per hour and the half-lifes ranged from 1.69 to 1.69 hours, respectively. Rate constants for the intraperitoneally administered aqueous extracts of *P.*

capense for the five doses ranged from 0.3082 to 0.5731 per hour and the half-lifes ranged from 2.25 to 1.21 hours, respectively. The rate constant for insulin was 0.4428 per hour and that of glibenclamide was 0.3277 per hour while their corresponding half-lifes were 1.57 and 2.11 hours, respectively.

Quanitative analysis of the phytochemical present of aqueous root extracts of *Piper capense*

Sample	Phytochemical Content (mg/g)				
	Total Phenols	Tannins	Flavonoids	Saponins	Alkaloids
Piper capense	4.94 ± 0.81	0.40 ± 0.07	1.72 ± 0.07	35.08 ± 1.17	4.67 ± 0.28
Quantities are expressed as Mean ± SD (Standard Deviation) of three samples for each extract. The expression of phytochemicals were mg per gram of lyophilate extract					

Table 3: Quantitative screening of the phytochemicals in the medicinal plant extract.

Phytochemical analysis of the aqueous root extracts of *Piper capense* showed the presence of Saponins, Flavonoids, Alkaloids, Terpenoids and Tannins as indicated in Table 3.

Discussion

The study was carried out to invastigate the antidiabetic activity of aqueous root extract of *Piper capense*. The aqueous root extracts of *Piper capense* administered at five doses (25 mg per kilogram body weight 48.4 mg per kilogram body weight, 93.5 mg per kilogram body weight, 180 mg per kilogram body weight, and 350 mg per kilogram body weight) showed antidiabetic activity in diabetic mice. The antidiabetic activity shown was irrespective of the amount of the dose administered which suggest uptake of bioactive constituents through active transport which is saturable.

The plasma glucose decreasing effect of *Piper capense* root extracts may be due to the presence of phenols, alkaloids, flavonoids, sterols and tannins that have been shown to have hypoglycemic activity [18]. Inhibition of alpha-amylase and alpha-glucosidase enzymes is responsible for antidiabetic activity of condensed tannins which are extracted from some foods in kenya [19]. The epigllo-catechin-3-gallate tannin also shows hypoglcemic activity as indicated by Broadhurst et al. [20,21]. Tannic acids commercially available induced phosphorylation of the insulin receptor (IR). It also helps in translocation of glucose transporter 4 (GLUT 4), which is the protein factors responsible for signaling pathway of insulin-mediated glucose transport [22]. Glauce et al. [23] reported that myricetin, a polyhydroxylated flavonol (flavonoid) has insulinomimetic properties and stimulate lipogenesis and transportation of glucose in the adipocytes hence lowering plasma glucose level [18].

The alkaloids indicated to be present in the aqueous root extract of *Piper capense* also have been reported to have antidiabetic activity. Berberine and tetrandine alkaloids are reported to show antioxidant activity which could be responsible for the different biological activities including antidiabetic activity. Also the alkaloid 1-ephedrine stimulates the regeneration of pancreas islets after the destruction of beta cells, this restores insulin secretion hence correcting hyperglycemia [18].

The aqueous root extract of *Piper capense* contained saponins. Saponins are shown to have antidiabetic activity. For instance, ginseng and its saponins have been shown to reduce plasma sugar in diabetic and normal mice [23]. Fractions of Saponin obtained from Momordica charantia decreased blood sugar levels and raised insulin secretion and synthesis of glycogen in alloxanised diabetic mice [24]. As reported by Chen and Zhang [25] saponins were shown to reduce serum glucose levels in elderly diabetic patients. Entada phaseoloides total saponins decreased fasted blood sugar significantly and reduced diabetic state associated oxidative stress in type two diabetic rats [26].

Conclusion

Administration orally of aqueous root extracts of *Piper capense* at 25 mg per kilogram body weight, 48.4 mg per kilogram body weight, 93.5 mg per kilogram body weight, 180 mg per kilogram body weight, and 350 mg per kilogram body weight demonstrated antidiabetic activity without irrespective of the amount of dose administered. The antidiabetic activity demonstrated could be due to the phytochemicals in *Piper capense*. The administration of the extracts at the five doses did not show any adverse effects on the diabetic mice. The study confirms that aqueous extract of *piper capense* has antidiabetic activity however research should be carried to animals that are physiologically similar to human like apes.

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