Anti-diabetic assessment of *Abelmoschus caillei* (A. Chev.) Stevels fruit extracts

Goddidit Esiro Enoyoze[1]* and MacDonald Idu[2]

1. Department of Biological Sciences, Edo University Iyamho, Edo State

2. Department of Plant Biology and Biotechnology, University of Benin, Benin City

Introduction

Diabetes is a condition characterized by accumulation of glucose in the blood underutilized. Management of diabetes without side effects is still a challenge to the medical system, as treatments for diabetes are relatively limited with significant side effects, making plant sources a target to explore new drugs. *Abelmoschus caillei* (A. Chev.) Stevels (*AC*), also known as West African okra, belongs to the family Malvaceae. *AC* fruits are used to manage diabetes in Nigeria, hence the aim of this study was to evaluate the anti-diabetic activity of aqueous and methanol extracts of *AC* at different doses in streptozotocin (STZ)-induced diabetic rats to provide a scientific basis for its use.

Methodology

- Fresh fruits of *AC* was purchased from Okpella market in Akoko-Edo L.G. A., Edo State, Nigeria in December, 2015. The fruits were washed, cut into smaller bits and shade dried. The dried plant materials were pulverized to coarse powdered form and extracted with methanol (using Soxhlet apparatus) and distilled water by cold maceration to obtain two extracts. Both extracts were concentrated by freeze-drying.
- Diabetes was induced in overnight fasted rats by a single intraperitoneal injection of 40 mg/kg body weight of STZ dissolved in 0.1M cold sodium citrate buffer, pH 4.2 and the control rats were injected with vehicle alone. The effect of the extracts was studied for 4 weeks and glibenclamide served as the standard drug.
- Biochemical parameters were evaluated using commercial kits obtained from Randox Laboratories, UK.
- The vital organs were isolated from the sacrificed rats and weighed in a battery operated digital weighing balance, then fixed in 10% formal saline for 24 hours, dehydrated in an alcohol-xylene series and embedded in paraffin. Sections were stained with haematoxylin and eosin for histological examination and photomicrographs were taken.

Acknowledgement: A special thanks to Edo University Iyamho for the financial support provided.

Results and Discussion

Table 1: Hypoglycaemic effect of aqueous and methanol extracts of *Abelmoschus caillei* in STZ-induced diabetic rats

Treatment Groups	Dose	Mean change of blood glucose (mg/dl) weeks after treatment					% reduction
		Initial	1st week	2nd week	3rd week	4th week	
Normal control	No treatment	95.33±7.06	90.00±5.00	79.67±1.45	57.67±5.18	73.67±2.96	22.72 %
STZ: Diabetic control	STZ + No treatment	303.00±30.2	320.0±14.00	344.0±27.54	379.0±57.30	418.7±93.81	No decrease
STZ + Glibenclamide	10 mg/kg	394.0±45.17	330.3±32.05	314.3±24.91	295.0±12.06	220.7±34.20*	43.98 %
STZ + Aq *AC*	200 mg/kg	212.3±42.19	142.3±33.01**	116.0±33.14*	102.7±28.76***	67.33±7.36***	68.29 %
STZ + Aq *AC*	400 mg/kg	297.7±46.04	183.3±36.33*	167.3±35.14	143.7±28.99***	130.0±17.39***	56.3 %
STZ + Meth. *AC*	200 mg/kg	249.5±39.55	269.0±21.94	229.0±38.68	190.0±45.03**	173.0±17.32**	30.7 %
STZ + Meth. *AC*	400 mg/kg	258.3±8.97	472.7±47.76*	291.3±93.60	127.0±19.09***	140.0±24.34**	45.8 %

Values are expressed as Mean ± SEM, P<0.05; n=4 Aq: Aqueous extract; Meth: Methanol extract

- Significant values at P<0.05; ** significant values at P<0.01; *** significant values at P<0.001, when compared to diabetic control group

The results revealed that both extracts were significant (P<0.05) in reducing the elevated blood glucose levels. The highest percentage reduction observed in the group treated with 200 mg/kg body weight aqueous extract at 68.29 %.

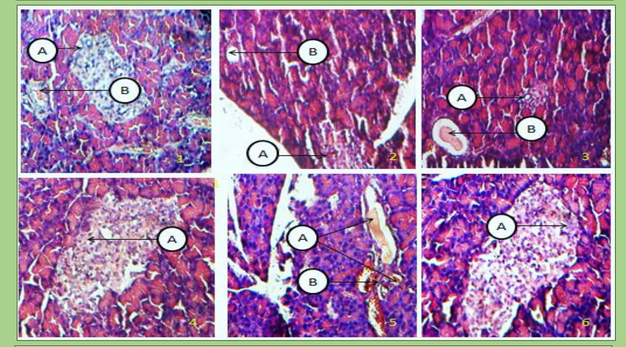
Table 2: Effect of aqueous and methanol extracts of *Abelmoschus caillei* on biochemical parameters in STZ induced diabetic rats.

Parameters	Normal control	STZ: Diabetic control	STZ + Glibenclamide (10 mg/kg)	STZ + AQ *AC* (200 mg/kg)	STZ + AQ *AC* (400 mg/kg)	STZ + Meth. *AC* (200 mg/kg)	STZ + Meth. *AC* (400 mg/kg)
CHOL (mg/dl)	83.21±37.90	60.15±7.81	105.80±38.13	88.72±25.18	41.10±12.65	60.90±0.43	112.80±31.07
HDL (mg/dl)	46.35±12.31	20.83±2.90*	37.15±2.73	33.86±0.60	37.15±3.31	34.12±1.65	33.68±1.06
LDL (mg/dl)	20.53±27.44	29.63±2.24	50.14±35.03	38.56±24.01	-4.98±14.64	13.53±7.27	63.73±29.27
AST (U/L)	11.47±4.47	14.27±0.99	3.50±0.00	23.15±3.26	16.83±1.51	10.85±4.24	13.42±1.72
ALT (U/L)	15.67±0.87	21.00±2.01	20.00±2.11	16.50±0.17	18.77±3.27	18.55±0.72	18.40±1.14
ALP (U/L)	35.35±7.47	85.81±19.51	101.3±23.55	31.53±2.30	49.58±4.65	55.35±14.59	52.05±12.92
ALB (mg/dl)	5.05±0.29	4.67±0.28	5.24±0.12	7.50±0.16**	4.89±0.20	5.44±0.70	4.37±0.69
TBIL (mg/dl)	1.53±0.29	1.11±0.28	1.30±0.23	2.15±0.60	2.08±0.50	1.60±0.04	1.16±0.05
DBIL (mg/dl)	0.54±0.09	0.96±0.24	0.74±0.02	1.06±0.16	1.04±0.14	2.14±0.61	0.88±0.25

CHOL: Cholesterol; HDL: High density lipoprotein; LDL: Low density lipoprotein; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; ALP: Alkaline phosphate; ALB: Albumin; T BIL: Total bilirubin; D BIL: Direct bilirubin

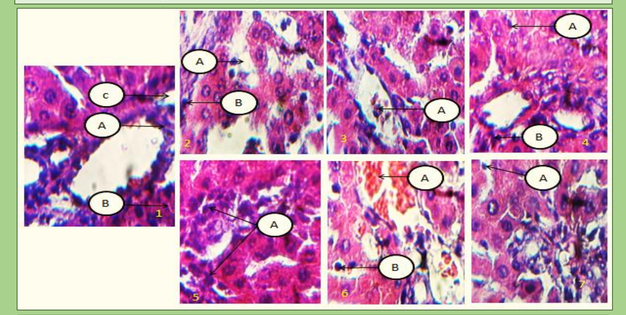
While other parameters remained within the normal ranges, the LDL level was higher than the HDL level in the diabetic control group, the groups treated with glibenclamide (10 mg/kg), AQ *AC* (200 mg/kg) and meth. *AC* (400 mg/kg) indicating the possibility of atherogenic risk. The total and direct bilirubin concentrations were elevated the most in groups treated with AQ *AC* at both doses used and in the group treated with meth. *AC* (200 mg/kg) indicating that these treatments best activated the possible protective properties of bilirubin.

Plate 1: Rat Pancreas (H&E x 100)



1) **STZ + Glibenclamide – A**-fairly resurgent islet and **B**-interlobar ductal proteinaceous material
2) **STZ + AQ AC (200 mg/kg) – A**-faintly resurgent islets and **B**-fairly dilated and patent interlobar duct
3) **STZ + AQ AC (400 mg/kg) – A**-faintly resurgent islets and **B**-mild luminal proteinaceous material
4) **STZ + Meth AC (200 mg/kg) – A**-fairly resurgent islets
5) **STZ: Diabetic Control – A**-moderate proteinaceous luminal casts and **B**-patchy vascular intimal erosion
6) **STZ + Meth AC (400 mg/kg) – A**-fairly resurgent islets

Plate 2: Rat liver (H&E X 400)



1) **Normal Control** – **A**-portal vein, **B**-hepatocytes and **C**-sinusoids
2) **STZ: Diabetic Control – A**-patchy macrovesicular steatosis and **B**-mild periportal infiltrates of lymphocytes
3) **STZ + Glibenclamide** – **A**-mild portal vascular congestion
4) **STZ + AQ *AC* (200 mg/kg)** – **A**-mild kupffer cell activation and **B**-mild periportal infiltrates of lymphocytes
5) **STZ + AQ *AC* (400 mg/kg) – A**-mild periportal infiltrates of lymphocytes
6) **STZ + Meth *AC* (200 mg/kg) –** A-mild vascular congestion and **B**-mild kupffer cell activation
7) **STZ + Meth *AC* (400 mg/kg) –** A-mild kupffer cell activation

Conclusion

Findings show that *Abelmoschus caillei* extracts possess anti-diabetic potentials at the doses tested, supporting the claims in the management of diabetes by traditional folks.