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Effects of Some Nigerian Medicinal Plants on Hyperglycemia and Dyslipidemia in Alloxan-Induced Diabetic Rats

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Abstract

This present work was designed to study the antidiabetic effect of four medicinal plants and their ability to reverse indicated dyslipidemia. The complications were accessed via atherogenic index (AI), coronary risk index (CRI) and cardiovascular risk index (CVRI). Sixty adult male albino rats weighing 125-136g were selected and divided randomly into 12 groups of 5 animals each for 18days, as follows (1) normal control group (2) negative control group (3) positive control (1) insulin, (4) positive control (Atorvastatin) (5) test group, cucurbita pepoli linn –LD (6) test group cucurbita pepoli linn –HD (7) solanum aethiopicum-LD (6) test group, solanum aethiopicum-HD (9) test group; spondias mombiin linn-LD (10) test group; spondias mombin linn -HD (II) test groups; Garcinia kola –LD (12) test groups; Garcinia kola-HD. Serum cooncentrations of total cholesterol (TC), low density lipoprotein (LDL), high-density lipoprotein cholesterol (HDL), triglycerides (TGs) and glucose were measured at the end of period in all studied groups. Administration of 200 and 400mg/kg aqueous extracts of the four medicinal plants resulted in a significantly decreased glucose, TC, TGs, LDL levels and increased HDL levels, as compared with the control group and diabetic control group. These results suggests that the aqueous extracts of the four medicinal plants exert significant effects on blood lipids and glucose level in diabetic rats and are useful in the tretament of diabetes. Increased AI, CRI, and CVRI were noted in the intoxicated rats and were reduced on treatment. The medicinal plants exerted antidiabetic effect and also reversed dyslipidemia associated with diabetes and prevented cardiovascular complications that are prevalent in diabetic patients.

Keywords: Hyperglycemia; Dyslipidemia; C. pepoli linn; S. aethiopicum; S. mombin linn; G. kola and albino rats.

1. Introduction

Diabetes mellitus is the most common chronic disease that affects the endocrine system. It is not a single disorder but a group of metabolic disorders that are characterized by chronic hyperglycemia and dyslipidemia, resulting from defects in insulin secretion, insulin action, or both [1].

There are three major types of Diabetes [2]. Type1 diabetes is usually diagnosed in childhood, hence called juvenile onset diabetes.

In this diabetes, the body makes little or no insulin and daily injection of insulin is needed. The exact cause is unknown but genetics, viruses or auto immune problems may play role [3]. Type II diabetes, the commonest type of Diabetes, occurs in adulthood nevertheless, young people are increasingly being diagnosed with this disease. Here, the pancreas produces insulin but the cells do not use it properly [4]. Gestational diabetes which is the third type of diabetes is high blood glucose condition that develops at anytime during pregnancy in non-diabetic individuals. Women who have this are at high risk of type II diabetes and may develop cardiovascular disease later in life [3].

Diabetic dyslipidemia is made obvious as lipoprotein lipase and cholesterylester hydrolase are activated and inhibited by insulin, respectively.

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Therefore insulin resistance and/or insulin deficiency may result in extremely elevated triglyceride levels, as a result of reduced activation of lipoprotein lipase. Similarly, in insulin deficiency/resistance, increased levels of non-esterified fatty acids (NEFA) are released as a result of reduced inhibition of cholesterylester hydrolase.

Dyslipidemia are traditionally classified by patterns of elevation in lipids and lipoproteins and categorized as increase in cholesterol only (pure or isolated hypercholesterolemia), increase in triglycerides only (pure or isolated hypertriglyceridemia) and increase in both cholesterol and triglycerides (mixed or combined hyperlipidemias) [5, 6].

Pure or mixed types of dyslipidemia may be consequence of obesity, poor control of diabetes or both, leading to increased hepatic very-low-density lipoprotein (VLDL) production [7].

The main indication for dyslipidemia treatment in diabetes is prevention of atherosclerosis, cardiovascular disease and pancreatitis [8]. The diabetic dyslipidemia is examplified by Artherogenic Index (AI), Coronary Risk Index (CRI) and Cardiovascular Risk Index (CVRI). While the current agents employed for the treatment of dyslipidemia are effective, these drugs have adverse effects which include liver enzyme elevations and muscle toxicity [9].

Treatment of diabetes centers round making available sufficient amount of insulin in the body system. The treatment of diabetes mellitus relied mainly on dietary measures which included the use of traditional plant based therapies before the introduction of insulin therapy in 1992 [10].

In recent decades, rats have been used in many experimental studies which have contributed to the understanding of genetics, disease and pharmacology. Alloxan monohydrate causes an insulin-dependent diabetes mellitus in experimental rats with characteristics similar to type I diabetes in humans [11].

Recent studies have demonstrated that some of the plant compounds show pharmacological effect and thus, the plants containing them, when consumed could confer varied levels of health benefits [12]. Considering this development, there is need for finding effective compounds with fewer side effects.

Four of such medicinal plants that have gained wide attention in the past decades are fluted pumpkin seed (*Cucurbita pepoli linn*), plum leaves (*Spodias mombinlinn),* bitter kola seed (*Garcinia kola*) and garden egg fruit (*Solanum aethiopicum*).

Fluted pumpkin seed (*Cucurbita pepoli linn*) of the family cucurbitaceae which is indigenous to southern Nigeria [13-15].

Garden egg fruit (*Solanum*) of the family *Solanaceae* is a fruiting shrub of the genus solanum mainly found in Asia and tropical Africa [16].

Plum leaves (*Spondias mombinlinn*) of the family Anarcadiacea. It is native to the tropical Americas, the tree has been naturized in parts of Africa.

Bitter kola seed (*Garcinia kola*) of the family guttiferae is found in Nigeria. Its natural habitat is subtropical or tropical moist lowland forest[17, 18].

With regards to the above mentioned facts, the present study was therefore undertaken to evaluate the effects of these Nigerian medicinal plants on hyperglycemia and dyslipidemia, in alloxan-induced diabetic rats.

2. Materials and Method

2.1. Material/Apparatus

Fresh samples of *Cucurbita pepoli linn* seed, *solanum aethiopicum* fruit, *Spondias mombin linn* leaves, *Garcinia kola* seed, beaker, conical flasks, crucible, filter papers, pipettes, oven, weighing balance, soxhlet extractor, measuring cylinder, centrifuge, electric grinder, syringes and needles, water bath, sterile sample bottles, dessicator.

2.2. Reagents/Chemicals Used

Alloxan monohydrate (St Louis, MD, USA), cholesterol reagent (Teco Diagnostics, USA), Triglyceride lipo reagent (Teco diagnosis, USA) and HDL cholesterol reagent (Agape Diagnostics, Switzerland), insulin (Novolog, USA), Atorvastatin (Unipex, USA). All other reagents used in the study were of high analytical grade.

2.3. Plant Sample Collection

Fresh samples of *Curcurbita pepoli linn* (fluted pumpkin) seeds, *solanum aethiopicum* (Garden egg) fruits, *Spondias mombinlinn* (Plum) leaves and *Garcinia kola* (Bitter kola) seeds were obtained from Umungasi market, Aba North Local Government Area of Abia State, Nigeria.

2.4. Experimental Animals

Sixty adult male albino rats with weight ranging from 125-136g were brought from the animal house of Department of Biochemistry, University of Nigeria, Nsukka. They were placed in twelve groups (A to H) with five rats in each group and kept in the animal house of the Department of Biochemistry, Ebonyi State University, Abakaliki for seven days, so that they acclimatized. All animals were allowed free access to rat chaw and water before and during the experiment.

3. Method

3.1. Plant Sample Preparation

The obtained healthy seeds of *Cucurbita pepoli linn*, fruits of *Solanum aethiopicum*, leaves of *Spondia mombinlinn* and seeds of Garcinia kola were thoroughly washed under running water and air-dried at room

temperature for several days. The dried samples were thereafter pulverized with the help of an electric blender and stored in air tight containers, then kept in a cool-dry place for further analysis.

A weight of 50g of each of the powdered samples was dissolved in 400ml of hot distilled water of temperature (40^0C- 60^0C) then allowed to cool for 1hour and filtered before being administered. Due to poor storage system, the aqueous extracts were prepared daily so that turbidity and bacteria actions were avoided.

3.2. Phytochemical Screening

Phytochemical screening of *Cucurbita pepoli linn* seeds, *Solanum aethiopicum* fruits, *Spondias mombinlinn* leaves and *Garcinia kola* seeds were carried out to detect the presence of glycosides, flavonoids, Alkaloids, Steroids, tannins and Saponins, following the standard methods as described by Ukpabi and Akubugwo [19].

3.3. Experimental Design and Treatment

The animals were grouped into twelve; with five rats in each group, as shown below.

Group A (Normal control)- This group was not intoxicated and was given access to food and water.

Group B (Negative control)- This group was induced with 1ml each of 100mg/kg alloxan ip without treatment.

Group C (Positive control; Insulin)- This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 40mg/kg insulin.

Group D (Positive control; Atorvastatin)- This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 30mg/kg Atorvastatin.

Group E_1 (Test group; Cucurbita pepoli linn LD) - This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 200mg/kg cucurbita pepoli linn.

Group E_2 (Test group: *Cucurbita pepoli linn HD*) - This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 400mg/kg *Cucurbita pepoli linn*.

Group F_1 (Test group; *Solanum aethiopicum LD*) - This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 200mg/kg *solanum aethiopicum*.

Group F_2(Test group: *Solanum aethiopicum HD*) - This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 400mg/kg *Solanum aethiopicum*.

Group G1 (Test group: *Spondias mombinlinn*-LD)- This group was induced with 1m each of 100mg/kg alloxan ip and treated with 200mg/kg *Spondias mombinlinn*.

Group G2 (Test group; *Spondias mombin linn*-HD)- This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 400mg/kg *Spondia mombin linn*.

Group H_1 (Test group; *Garcinia kola*-LD)- This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 200mg/kg *Garcinia kola*.

Group H_2 (Test group; *Garcinia kola*- HD)- This group was induced with 1ml each of 100mg/kg alloxan ip and treated with 400mg/kg *Garcinia kola*.

4. Induction of Diabetes Mellitus

Diabetes mellitus was induced in the rats by the process of injection. The freshly prepared alloxan monohydrate was intraperitioneally injected at a dosage of 100mg/kg body weight. The development of Diabetes was confirmed after three days of alloxanization by using Accucheck active glucometer (Roche diagnostic). Rats that had blood glucose levels above 250mg/kg were considered diabetic and thus selected for the study.

Subsequently, treatment regimes of hyperglycemia and hyperlipidemia started on the 4^{th}, 8^{th} and 12^{th} days of the experiment, respectively.

4.1. Biochemical Analysis

4.1.1. Collection of Blood Samples

After administration of the various samples, the animals were left without food for 12hours. Blood samples were collected into clean tubes by cardiac puncture, then centrifuged at 2000rpm for 10minutes, using a centrifuge, to recover serum for biochemical assay.

4.1.2. Glucose Estimation

Glucose is a major carbohydrate present in the blood and serves as a primary source of energy. An enzyme that is highly specific for glucose is the glucose oxidase; it catalyzes the oxidation of beta D-glucose present in the plasma to D-glucono-1,5-lactone, with the formation of hydrogen perioxide. The lactone is then slowly hydrolyzed to D-gluconic acid. In the presence of the peroxidase enzyme, the hydrogen peroxide is broken down and the released oxygen reacts with 4-aminophenazone and phenol to give a pink color. The absorption of the color produced was measured in a spectrophotometer.

4.1.3. Lipid Profile Analysis

The plasma total cholesterol (TC), triglycerides (TGs) and HDL (high density lipoprotein) were measured using commercial kits via enzyme coupled reactions and the colored complex, measured by spectrophotometer. LDL (Low Density lipoprotein) was calculated using FriedWald's equation [20]

4.1.4. Determination of Atherogenic Index (Ai), Coronary Risk Index (Cri) and Cardiovascular Risk Index (Cvri)

The AI, CRI and CVRI were respectively calculated using the formulae below [8, 21, 22].

1. AI = $\frac{\text{LDL Cholesterol}}{\text{HDL cholesterol}}$
2. CRI = $\frac{\text{TC}}{\text{HDL cholesterol}}$
3. CVRI = $\frac{\text{TGs}}{\text{HDL cholesterol}}$

4.2. Statistical Analysis

The results from the analysis were expressed as mean + SD and $p < 0.05$, being considered as statistically significant.

5. Results

5.1. Phytochemical Composition of Aqueous Plants Extract of the Four Examined Medicinal Plants

The results obtained from the phytochemical analysis showed that the aqueous extract of the four medicinal plants gave positive reactions for tannins, Alkaloids, saponins and flavonoids. Saponins reaction showed the deepest coloration in *C. pepoli linn, S. mombinlinn, G. kola*, while flavonoids reaction showed the deepest coloration in *S, aethiopicum*.

Table-1. Phytochemical screening of the various medicinal plant extracts examined

S/N	Phytochemicals constituents	Test	Qualitative abundance			
			Cucurbita pepoli linn	**Spondias mombin linn**	**Garcinia kola**	**Solanum aethiopicum**
1.	Alkaloids	(a). Mayers test (b) Murexide test	+ + + +	+ + + +	+ + + +	+ +
2.	Tannins	(a) 5% $FeCl_3$ (b) Dilute $HN0_3$	+ +	+ +	+ + + +	+ +
3.	Flavonoids	(a) Lead acetate (b) Sodium hydroxide	+ +	+ +	+ + + +	+ + + + + +
4.	Saponins	(a) Frothing (b) Emulsion test	+ + + + + +	+ + + + + +	+ + + + + +	+ + + +

(+) Present at low levels, (++) present at moderate levels, (+++) present at high levels

5.2. Serum Glucose Levels in Albino Rats Following the Induction of Alloxan and Treatment with the Various Medicinal Plants

Measurement of blood glucose levels in the rats showed that the diabetic control groups that were intoxicated with alloxan monohydrate had increased levels of blood glucose. Blood glucose concentration in the four diabetic groups that were treated with *Cucurbita pepoli linn, Spondias mombin linn, Garcinia Kola*, and *Solanum aethiopicum* extracts showed significant decrease as compared to diabetic controls. The decrease of blood glucose levels was dose dependent. There was no significant difference in the rate of reduction observed in the reference drug (Insulin) and the four medicinal plants at low dose level.

Table-2. Serum glucose levels in albino rats following the induction of alloxan and treatment with the various medicinal plant extracts

Groups	Initial Glucose Conc. (mg/dl)	Glucose Conc. After 6days of treatment (mg/dl)	Glucose Conc. After 9days of treatment (mg/dl)	Glucose Conc. After 12days of treatment (mg/dl)
A	83.00±2.30	83.40±3.20	84.00±1.98	85.50±2.91
B	283.33±1.34	268.58±1.61	271.23±1.15	266.85±3.00
C	280.00±1.34	210.23±2.96	160.12±1.33	1.0013±1.91
E_1(PS-LD)	288.09±3.45	291.10±2.50	165.20±1.54	106.51±1.45
E_2(PS-HD)	289.10±2.72	267.21±2.56	174.11±2.03	94.20±3.80
F_1(PLU-LD)	280.30±2.04	210.44±1.01	155.30±0.90	98.10±2.05
F_2(PLU-HD)	288.00±0.54	180.51±2.03	130.00±1.97	86.13±3.04
G_1(BKS-LD)	279.00±2.03	200.43±1.01	151.30±0.90	99.10±2.06
G_2(BKS-HD)	286.00±0.52	190.51±2.06	120.00±10.00	87.12±3.01
H_1(GES-LD)	285.00±7.23	220.00±7.30	170.00±13.87	127.00±6.90
H_2(GES-HD)	287.00±8.10	190.10±3.50	130.00±1.76	90.00±4.00

PS-LD indicates pumpkin seed low dose, PS-HD, pumpkin seed high dose, PLU-LD , plum leaves low dose, PLU –HD, plum leaves high dose, BKS-LD, bitter kola seed low dose, BKS-HD , bitter kola seed high dose, GES-LD, garden egg sample low dose, GES-HD, garden egg sample high dose.
Values represent the mean ± SD of triplicate readings (n=5).

Table-3. Effect of alloxan monohydrate induction on lipid profile of albino rats

Lipid profile	TC				TGs				LDL				HDL			
	PS	PLU	BKS	GES	PS	PLU	BKS	GES	PS	PLU	BKS	GES	PS	PLU	BKS	GES
Group A	80.51± 0.22	80.51± 0.22	80.51± 0.22	80.51± 0.22	81.87±0.14	81.87± 0.14	81.87± 0.14	81.87± 0.14	28.82± 0.11	28.82± 0.11	28.82± 0.11	28.82± 0.11	38.64± 0.15	38.64± 0.15	38.64± 0.15	38.64± 0.15
Group B	149.89± 0.20	149.89± 0.20	149.89± 0.20	149.89± 0.20	159.21± 0.12	159.21± 0.12	159.21± 0.12	159.21± 0.12	53.19± 0.18	53.19± 0.18	53.19± 0.18	53.19± 0.18	23.53± 0.19	23.53± 0.19	23.53± 0.19	23.53± 0.19

TC indicates Total cholesterol, TGs, Triglycerides, LDL, Low density lipoprotein, HDL, High density lipoprotein
Values represent the mean ± SD of triplicate readings (n=5)

5.3. The Effect of Atorvastatin and the Various Medicinal Plants on TC, TGs, LDL and HDL of the Diabetic Rats

The result showed that the treatment of diabetic rats with C.pepoli,linn S. mombin linn ,G. kola, S. aethiopcium and atorvastatin caused significant ($p<0.05$) decrease in TC, TGs, and LDL. On the other hand HDL was significantly increased.

From the statistical analysis, the increment in TC and TGs levels in rats that were treated with GES was more than that of the other medicinal plants.

Table-4. The effect of atorvastatin and the various medicinal plant extracts on TC, TGS, LDL and HDL of the diabetic rats

Lipid profile	TC		TGS		LDL		HDL	
Groups	13th day	18th day	13th day	18th day	13th day	18th day	13th day	18th day
AVT	119.88±3.12	86.29±2.57	121.77± 3.38	84.63± 2.84	49.60± 0.95	29.60±2.03	29.00±1.60	37.48± 4.56
PS-LD	136.96±4.80	130.74±3.62	147.79±4.83	139.63±5.63	51.06±2.45	46.79±1.31	24.83±1.03	32.66±2.10
PS-HD	113.69±5.69	97.23±4.19	105.65±4.31	96.07±3.66	48.33± 2.35	43.02±2.12	32.65±3.49	35.16±4.79
PLU-LD	138.40±2.79	129.89±1.71	142.72±2.19	131.21±2.18	52.65±2.83	49.44± 1.61	27.83±1.91	30.20±2.06
PLU-HD	15.59±3.35	94.81±2.37	109.72±2.1	92.28±2.32	42.78±2.66	40.94±3.30	37.23±1.87	43.03±1.75
BKS-LD	136.99±2.84	128.80±1.49	148.68±2.59	132.14±2.59	49.93±2.20	45.32±2.96	27.93±2.20	30.68±0.63
BKS-HD	107.88±1.9	91.99±2.25	109.99±2.62	89.79±1.58	39.73±4.01	30+73±1.18	33.19±0.64	40.42±1.66
GES-LD	136.55±3.35	115.88±6.09	143.61± 4.95	125.78±5.00	53.00±0.91	49.64±2.20	29.33±1.32	30.99±1.68
GES-HD	108.24±4.07	97.39±4.07	111.0±2.11	98.64±2.1	45.55±4.10	40.28±4.10	36.70±1.69	38.12±1.69

AVT indicates Atorvastatin, PS-LD, Pumpkin Seed Low Dose,PS-HD, Pumpkin Seed High Dose, PLU-LD, Plum Leaves Low Dose, PLU-HD, Plum Leaves High Dose, BKS-LD, Bitter kola Seed Low Dose, BKS-HD, Bitter kola Seed High Dose, GES-LD, Garden Egg Sample Low Dose, GES-HD, Garden Egg Sample High Dose.
Values represent the mean ± SD of triplicate readings (n=5).

5.4. Effect of the Various Medicinal Plant Extracts on AI, CRI, and CVRI of Diabetic rats

The result shows that AVT, PS, PLU, BKS, and GES are capable of reducing risk of AI, CRI, and CVRI in diabetic rats. In cause of risk reduction CRI and CVRI, GES is the most effective outside the reference drug (Atorvastatin).

Table-5. Effect of the various medicinal plant extracts on AI, CRI, and CVRI of diabetic rats

Lipid profile	AI		CRI		CVRI	
Groups/Days	13TH	18TH	13TH	18TH	13TH	18TH
AVT	1.607	0.784	4.135	2.380	4.200	2.197
PS-LD	2.056	1.432	5.515	4.003	5.952	4.275
PS-HD	1.480	1.223	3.490	2.765	3.235	2.732
PLU-LD	1.892	1.637	4.973	4.301	5.123	4.345
PLU-HD	1.143	0.951	2.836	2.203	2.947	2.145
BKS-LD	1.787	1.474	4.904	4.138	5.323	4.307
BKS-HD	1.197	0.760	3.250	2.275	3.313	2.221
GES-LD	1.807	1.602	4.656	3.733	4.895	4.054
GES-HD	1.241	1.056	2.943	2.555	3.025	2.588

AVT indicates Atorvastatin, PS-LD, Pumpkin Seed Low Dose, PS-HD, Pumpkin Seed High Dose, PLU-LD, Plum Leaves Low Dose, PLU-HD, Plum Leaves High Dose, BKS-LD,Bitter Kola Seed Low Dose, BKS-HD, Bitter Kola Seed High Dose, GES-LD, Garden Egg Sample Low Dose, GES-HD: Garden Egg Sample High Dose, AI, Atherogenic index, CRI, Coronary risk index, CVRI, Cardiovascular risk index.
Values represent the mean ± SD of triplicate readings (n=5).

6. Discussion

This study investigated the effect of some Nigerian Medicinal herbs extracts as possible cure for diabetes mellitus and its complications. To experiment this, alloxan monohydrate injection was used to induce diabetes in the albino rats. The diabetic rats were under oral administration of aqueous extracts of the herbs in two doses (200mg/kg

and 400mg/kg). The study revealed significant increase in the blood glucose level as observed in alloxan induced diabetic rats. Alloxan intoxication cause intense reduction of insulin release by the destruction of beta cells of the Islets of Langerhans [10]. By this development, the adipose tissue and skeletal muscles are not able to take up glucose from serum, in insulin deficency. Hence, glucose conversion to fat and glycogen is blocked in the adipose tissue and skeletal muscles, giving rise to increase of blood glucose level.

In the current study, the diabetic rats that were treated with aqueous extracts of pumpkin seed (*Cucurbita pepoli linn*), plum leaves (*Spondias mombin linn*), bitter kola (*Garcinia kola*) and garden egg fruit (*Solanum aethiopicum*) had decrease blood glucose levels, previously elevated by alloxan monohydrate. However, the garden egg fruit had the least glucose lowering effect. The phytochemical screening of the four herbs extracts indicated the presence of useful compounds such as flavoniods, tannins, saponins and alkanoids. Saponins were found to be present at high levels in pumpkin seed, plum leaves and bitter kola seed, where as they were present at moderate level in garden egg fruit.

They are glycosidic compounds that have been shown to have potential therapeutic benefits especially in decreasing serum blood glucose level in patients suffering from diabetes [23].

Their antidiabetic activity is through the release of insulin from the pancreas.

Similarly, flavonoids showed highest positive reaction in garden egg fruit. New studies have suggested that eating high level of flavoniods could offer protection from type II diabetes by lowering insulin resistance and improving blood glucose regulation.

Flavonoids also may have beneficial actions in obesity, due to their capacity to regulate fatty oxidation and improve adipocyte functionality.

Another characteristic feature of severe diabetes is an elevated concentration of serum lipid parameters. The abnormally high concentration of serum lipids in diabetes is mainly due to the increase in the production of free fatty acids from the peripheral fat depots.

The elevation in blood sugar was accompanied by marked increase in cholesterol, triglycerides, low density lipoprotein and a reduction in high density lipoprotein. The oral administration of the aqueous extracts of the four medicinal plants and the reference drug (Atorvastatin) lowered plasma, TC, TGs , LDL levels and increased HDL concentrations normals the abnormality in diabetic rats.

The two common lipid abnormalies noted in this study were TC and TGs. An elevation of blood TGs and TC levels is a major indicator of body dyslipedemia which chronically leads to the increase of coronary heart injury [1].

The effect of the four medicinal plants on CVD risk (such as AI=LDL/HDL, CRI= TC/HDL and CVRI=TGs/HDL) in diabetic rats was evaluated. Increased AI, CRI and CVRI were noted in the intoxicated disease rats and have been reported in other works [24].

The administration of the four medicinal plants reduced AI, CRI and CVRI, which indicated that they can decrease the risk of cardiovascular disease in diabetic rats. Although their reduction was not significant when compared with Atorvastatin.

Garden egg fruit significantly reduced CRI and CVRI in diabetic rats at low dose when compared with the other three medicinal plants. At high dose, plum leaves recorded the highest reduction among others. This may be attributed to high fiber content observed in these plants [25]. Various soluble fibers have been shown to significantly reduce total cholesterol and LDL cholesterol.

Similarly, pumpkin seed had significant reduction of AI when compared with the other three medicinal herbs, while Bitter kola had the highest reduction at high dose. The effectiveness may be attributed to increased HDL production and inhibited HDL clearance.

The commonest lipid abnormality observed in this study was high TG (41.54%) followed by TC (37.25%) and the least HDL (8.11%). This is in agreement with the findings that lipoprotein lipase and cholesteryl hyrolyase is sentitive to insulin. Reduced inhibition of choleseryl hydrogen and reduced activation of lipoprotein lipase would result in increas and levels of TGs.

7. Conclusion

This study investigated the effect of form Nigeria medicinal plants extracts as alleviation therapy for diabetes complicaiton. It was observed that the oral administration of the plant extracts significantly decreased the blood glucose levels, cholesterol triglycerides, low density lipoprotein and devataed high density lipoprotein, after alloxanization increasingly Al, CRI and CVRI were noted in the intoxicated rats and were reduced on treatment. The medicinal plants exerted antidiabetic effect and also reversed dyslipidemia associated with diabetes and prevented cardiovascular complicaitons that are prevalent in diabetic patients.

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