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Research Article

# Evaluation of Anti Diabetic Activity of Ethanolic Extract of Caralluma umballeta haw in Streptozotocin Induced Diabetic Rats

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**ABSTRACT**
Indigenous drug Carraluma umballeta Haw used by different ethnic groups of the world for the treatment of diseases have special significance from long time like diabetes, wounds, cuts, hepatoprotective, etc. No scientific work has been carried out on the leaf of Carraluma umballeta Haw.The present work is undertaken to produce pharmacological standards and this founding's may help to proper identification and ensures the quality of the drug. It may help this amazing plant grown on commercial basis for better use in pharmaceutical herbal The extract of Carraluma umballeta Haw was done by using soxhlet apparatus with ethonal. With Ethanolic extract of Carraluma umballeta Haw the pharmacological actions were observed by measuring anti diabetic activity in streptozotocin induced diabetic rats.The pharmacological experiments was conformed that ethanolic extract of Carraluma umballeta Haw has anti diabetic activity which was evaluated in streptozotocin induced rats. After inducing diabeties the standard drug Glibincimide showed blood glucose levels 257,226,195,135,116 at the dose of10 mg/kg. Where as the ehanolic extract showed 265,226,166,122,107 at the dose of 400mg/kg at intervels of 0th,5th,10th,15th and 20th day respectively.

**Key words**: Herbal medicines, Streptozotocin, Glibenclamide, antidiabetic activity.

## INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by a high blood glucose concentration-hyperglycemia (fasting plasma glucose > 7.0 mmol/l or plasma glucose > 11.1 mmol/l 2 h after a meal) caused by insulin deficiency, often combined with insulin resistance. Hyperglycemia occurs because of uncontrolled hepatic glucose output and reduced uptake of glucose spills over into the urine (glycosuria) and causes an osmotic diuresis (polyuria), which in turn results in dehydration, thirst and increased drinking (polydypsia) [1].

The Mechanism of Pancreatic β-cell Destruction by Streptozotocin (STZ)

The glucose moiety directs this agent to the pancreatic β-cells, where it binds to a membrane receptor to cause structural damage [2]. The deleterious effect of STZ results from the generation of highly reactive carbonium ions (CH3+) that cause DNA breaks by alkylating DNA bases at various positions, resulting in activation of the nuclear enzyme, poly (ADP-ribose) synthetase, thereby depleting the cellular enzyme substrate (NAD+), leading to cessation of NAD+-dependent energy and protein metabolism[3]. This in turn leads to reduced insulin secretion. It has been suggested that free radical stress occurred during β-cell destruction mediated by mononuclear phagocytes and cytokines [3].Since free radical scavengers have been demonstrated to protect against the diabetogenic properties of STZ, it is likely that oxidative stress may play a role in determining STZ toxicity. Some poly (ADP-ribose) synthetase inhibitors, such as nicotinamide and 3-aminobenzamide, could prevent the onset of diabetes. It was also reported that metallothionein, a free radical scavenger, could provide some protection against the diabetogenic properties of STZ [3,4]. Cytoprotective components, such as zinc and lipid components from the soybean may prevent β-cell death by stabilizing membrane integrity and normalizing membrane biochemical alterations [5].

## METHODOLOGY

Collection and Authentication of Cralluma umbleta HAW

The fresh stems and flowers of caralluma umbellata were collected from Thirupathi hills of Chittur district,Andhra pradesh. It was then properly identified by the Botanist

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Table 1: Antioxidant activity by DPPH method

| Extract | % Inhibition of DPPH at Various Concentration | | | | | | IC 50 |
|---|---|---|---|---|---|---|---|
| | 10 (µg/ml) | 20 (µg/ml) | 40 (µg/ml) | 60 (µg/ml) | 80 (µg/ml) | 100 (µg/ml) | (µg/ml) |
| Standard (Ascorbic acid) | 24.53[a] | 48.20 [a] | 62.19 [a] | 81.52 [a] | 93.70 [a] | 99.94 [a] | |
| n-Hexane | 4.85 | 11.63 | 25.53 | 36.92 | 48.71 | 51.65 | 85 |
| Chloroform | 10.49 | 25.56 | 32.44 | 55.7 | 62.31 | 71.59 | 54.5 |
| Ethyl acetate | 7.85 | 13.53 | 29.62 | 43.37 | 50.68 | 59.8 | 53 |
| Ethanol | 17.33 | 32.18 | 45.57 | 63.33 | 72.55 | 82.62 | 45 |
| Aqueous | 9.47 | 18.27 | 34.62 | 44.66 | 52.3 | 61.45 | 74 |

*Data are means ±SEM for three measurements. [a] P < 0.001 compared to all extracts*

Table 2: Effects of various plant extracts (50 gm / l) of *Carallum umblleta HAW* on the movement of glucose out of dialysis tube over 27 hr incubation periods

| Extract | 1 hr | 3 hr | 5 hr | 24 hr | 27 hr |
|---|---|---|---|---|---|
| Control (in the absence of extract) | 125.33 ± 0.33 | 195 ± 0.57 | 234.33 ± 0.88 | 301.33 ± 0.33 | 316.33 ± 0.88 |
| n – Hexane (50 g/l) | 101.33 ± 0.33[a] | 177.33 ± 0.66 [a] | 207.33 ± 1.22 [a] | 281 ± 0.57 [a] | 303 ± 1.15 [a] |
| Chloroform (50 g/l) | 97.33 ± 0.33 [a] | 166 ± 0.57 [a] | 202 ± 0.57 [a] | 264.66 ± 1.45 [a] | 277.33 ± 1.20 [a] |
| Ethylacetate (50 g/l) | 87.66 ± 0.33 [a] | 152.33 ± 0.88 [a] | 196.66 ± 0.88 [a] | 246.33 ± 0.88 [a] | 254.66 ± 0.33 [a] |
| Ethanol (50 g/l) | 75.33 ± 0.88 [a] | 102 ± 1.52 [a] | 145 ± 1.73 [a] | 196.33 ± 0.88 [a] | 204.66 ± 1.76 [a] |
| Aqueous extract (50 g/l) | 82.33 ± 0.88 [a] | 116.66 ± 0.88 [a] | 155.66 ± 1.20 [a] | 224.66 ± 1.45 [a] | 228.66 ± 0.33 [a] |

*Values are expressed as mean + SEM n=3; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001 compared to control.*

Table 3: Antidiabetic effect of ethanolic extract of *Carallum umblleta HAW* in OGTT

| Treatment | Mean blood glucose concentration (mg/dl) | | | |
|---|---|---|---|---|
| | 0 min | 30 min | 60 min | 120 min |
| Control | 113.5 ± 0.76 | 256.5 ± 0.56 | 295.66 ± 0.49 | 156.33 ± 0.33 |
| EECU 100 mg / kg | 106.16 ± 0.6[a] | 244.16 ± 0.6 [a] | 157.16 ± 0.6 [a] | 134.66 ± 0.33 [a] |
| EECU200 mg / kg | 104.83 ± 0.3 [a] | 235.66 ± 0.55 [a] | 143.83 ± 0.47 [a] | 126 ± 0.68 [a] |
| EECU400 mg / kg | 102.5 ± 0.61 [a] | 223.5 ± 0.56 [a] | 133.66 ± 0.66 [a] | 113.5 ± 0.71 [a] |

*Values are expressed as mean + SEM n=6; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001 compared to control.*

Prof.P.Jayaraman, Plant Anatomy Research Centre, Tambaram, Chennai. He confirmed and authenticated its identity. Authentication number is (PARC/2013/1253). A voucher specimen has been reserved in the Department of Pharmacognosy, Narasaraopet institute of pharmaceutical science ,narasaraopeta.

Preparation of Extract [6,7]

Extraction is the preliminary step involved in the pharmacological studies which brings the metabolite into the solvent. Solubility of metabolite is according to its polarity. In order to obtain the uniform sized particle, thestems and flowers powder was sieved. The various extracts prepared by successive exhaustive solvent extraction of coarsely powdered stems and flowers offcaralluma umbleta in increasing order of polarity viz., n-Hexane, Chloroform, Ethyl acetate, Ethanol and Water: Chloroform (99:1) to effect the extraction. Aqueous extract was obtained with chloroform water by maceration. Once the extraction is over, the solvent was immediately filtered through funnel with cotton, evaporated by Rotary evaporator and preserved for further studies.

Pharmacological Screening [8]

Drugs and chemicals: All chemicals in the present study were of analytical grade, product of Sigma, Merck and Aldrich.

Test animals : Wistar albino rats (either sex) weighing (180 – 220 g) were used in the experiment. The animals were kept in polypropylene cages (3 in each cage) at an ambient temperature of 25 ± 2°C with 55-65% relative humidity at 12-12 h light and dark schedule throughout the study. The rats had free access to water and were fed with commercially available feed (Hindustan Lever, India). The animals were fasted for 16h before experimentation but allowed free access to water. The experimental protocol was approved by the institutional animal ethical committee.

Determination of DPPH Radical Scavenging Activity [9, 10]

Table 4: Effect of ethanolic extract of *Carallum umblleta HAW* on glucose level in streptozocin induced diabetic rats

| Treatment | Serum glucose level (mg / dl) 0 day | 5th day | 10th day | 15th day | 20th day |
|---|---|---|---|---|---|
| Control | 105.16 ±0.70 | 109 ±0.73 | 116.33 ±0.42 | 117.66 ±0.42 | 121 ±0.25 |
| Diseasecontrol (STZ) | 284.33 ±0.30[a] | 265 ±0.51 [a] | 259.83 ±0.47 [a] | 253 ±0.51 [a] | 244.33 ±0.33 [a] |
| Glibenclamide (10 mg / kg) | 257 ±0.36 [a] | 226 ±0.57 [a] | 195 ±0.36 [a] | 135.16 ±0.94 [a] | 116 ±0.68 [a] |
| EECU (100 mg / kg) | 277.33 ±0.66 [a] | 246.5 ±0.56 [a] | 196.16 ±0.47 [a] | 176 ±0.68 [a] | 135.88 ±0.60 [a] |
| EECU (200 mg / kg ) | 271.16 ±0.83 [a] | 235.66 ±0.42 [a] | 187 ±0.89 [a] | 162.66 ±0.33 [a] | 117 ±0.36 [a] |
| EECU (400 mg / kg ) | 265.66 ±0.42 [a] | 226.83 ±0.47 [a] | 166 ±0.57 [a] | 122.66 ±0.61 [a] | 107.16 ±0.60 [a] |

*Values are expressed as mean + SEM n=6; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001 compared to control.*

Table 5: Effect of ethanolic extract of *Carallum umblleta HAW* on plasma glucose, insulin, total haemoglobin, glycosylated haemoglobin and hepatic glycogen in normal and Streptozotocin-induced diabetic rats

| Groups | Plasmaglucose(g / dl) | Plasmainsulin( µU / ml ) | Total Hb( g / dl) | GlycosylatedHB (%) | Liver glycogen (mg / g of wet tissue) |
|---|---|---|---|---|---|
| Control | 64.5 ± 0.42 | 16.16 ± 0.03 | 15.61 ± 0.04 | 5.58 ± 0.01 | 10.48 ± 0.01 |
| STZ induced diabetic control | 284.83 ± 0.30[a] | 6.76 ± 0.06 [a] | 12.83 ± 0.07 [a] | 7.63 ± 0.06 [a] | 5.68 ± 0.04 [a] |
| STZ + EECU (100 mg / kg) | 136.16 ± 0.60 [a] | 12.44 ± 0.02 [a] | 14.3 ± 0.05[b] | 4.65 ± 0.03 | 9.86 ± 0.02 [a] |
| STZ + EECU (200 mg / kg ) | 125.33 ± 0.42 [a] | 12.25 ± 0.01 [a] | 13.75 ± 0.03 [a] | 4.46 ± 0.02 | 9.7 ± 0.03 [a] |
| STZ + EECU (400 mg / kg ) | 114.83 ± 0.3 [a] | 12.15 ± 0.005 [a] | 13.61 ± 0.07 [a] | 4.21 ± 0.01[b] | 9.21 ± 0.01 [a] |
| STZ + Glibenclamide (10 mg / kg ) | 185 ± 0.36 [a] | 13.46 ± 0.02 [a] | 13.58 ± 0.04 [a] | 4.31 ± 0.004 [a] | 8.2 ± 0.007 [a] |

*Values are diabetic control expressed as mean + SEM n=6; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001, [b] p<0.05 compared to control.*

Table 6: Effect of ethanolic extract of *Carallum umblleta HAW* on serum total cholesterol, triglycerides, HDL and LDL levels in normal and streptozotocin- induced diabetic rats

| Groups | Total cholesterol (mg / dl) | Triglycerides (mg / dl) | HDL (mg / dl) | LDL (mg / dl) |
|---|---|---|---|---|
| Control | 82 ± 0.57 | 85.83 ± 0.30 | 57.3 ± 0.33 | 33.83 ± 0.30 |
| STZ induced diabetic control | 125.5 ± 0.22[a] | 126 ± 0.36 [a] | 27 ± 0.51 [a] | 43.16 ± 0.60 [a] |
| STZ + EECU (100 mg / kg) | 80 ± 0.25 [a] | 81.5 ± 0.42 [a] | 30.4 ± 0.06 [a] | 33.5 ± 0.25 [a] |
| STZ + EECU (200 mg / kg ) | 77 ± 0.36 [a] | 75.5 ± 0.34 [a] | 29.2 ± 0.04 [a] | 32.5 ± 0.02 [a] |
| STZ + EECU (400 mg / kg ) | 76.83 ± 0.16 [a] | 74.5 ± 0.22 [a] | 27.15 ± 0.03 [a] | 31.5 ± 0.02 [a] |
| STZ +Glibenclamide (10 mg / kg ) | 75 ± 0.25 [a] | 77.8 ± 0.3 [a] | 29 ± 0.36 [a] | 30.3 ± 0.21 [a] |

*Values are diabetic control expressed as mean + SEM n=6; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001, compared to control.*

DPPH Free Radical Scavenging Capacity Assay: The free radical scavenging activity of the extract, based on the scavenging of the stable 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radical, was studied. 200µl of plant extracts of various solvents or standard of different concentration were taken in different test tubes and 2 ml of reagent solution (0.004 gm of DPPH in 100 ml ethanol) was added to each test tube. The test tubes were incubated for 30 minutes to complete the reaction. The absorbance's of the solutions were measured at 517nm using a spectrophotometer against blank The percentage (%) inhibition activity was calculated from the equation:

$[(A0 – A1) /A0] \times 100$.

Where, A0 is the absorbance of the control, and
A1 is the absorbance of the extract or standard.

Then percentage inhibitions were plotted against concentration

Pharmacological Screening

In vitro antidiabetic activity (By Glucose Diffusion Inhibitory Study) [] 11, 12, 13, 14]

A simple model system was used to evaluate the effects of plant extracts on glucose movement in vitro. The model was adapted from a method described by Edwards et al., 1987, which involved the use of a sealed dialysis tube into which 15ml of a solution of glucose and sodium chloride (0.15M) was introduced and the appearance of glucose in the external solution was measured. The model used in the present experiment consisted of a dialysis tube (6cmX15mm) into which 1ml of 50g/litre plant extract in 1% CMC and 1ml of 0.15M sodium chloride containing 0.22M D-glucose was added. The dialysis tube was sealed at each end placed in a 50ml centrifuge tube containing 45ml of 0.15M sodium chloride. The tubes were placed on an orbital shaker and kept at room temperature. The movement of glucose into the external solution was monitored at set time intervals

Acute toxicity studies [15]

Acute oral toxicity study was performed as per OECD-423 guidelines (acute toxic class method). Wistar rats (n = 6) of either sex selected by random sampling technique were used for the study. The animals were kept fasting for overnight providing only water, after which the plant extract was administered orally and observed for 14 days. If mortality was observed in 2 - 3 animals, then the dose administered was assigned as toxic dose. If mortality was observed in one animal, then the same dose was repeated again to confirm the toxic dose. If mortality was not observed, the procedure was repeated for further doses.

Oral glucose tolerance test in normal rats (OGTT) [] 17, 18]

Rats were divided into four groups (n = 6). They were fasted overnight and accessed to water only. Blood was taken from the lateral veins of the tail and the blood sugar levels were initially monitored with a glucometer. Above groups were treated with vehicle (0.5% Tween 80 solution), ethanolic extract II, III, and IV (100, 200 and 400 mg/kg, p.o., each). After 30 min, the animals were treated with 5% (wt/v) glucose orally. Blood glucose levels were monitored from lateral tail veins at 30, 60, and 120 min intervals after post glucose challenge.

Invivo Anti-diabetic evaluation

Experimental induction of diabetes [24, 26, 27]

Induction of diabetic mellitus: Adult (9-week-old) Wistar rats were made diabetic with an intraperitoneal injection of STZ (50 mg/kg body weight) dissolved in citrate buffer (0.1 M, pH 4.5). STZ-injected animals exhibited massive glycosuria and hyperglycemia within a few days. After the injection, they had free access to feed and water and were given 5% glucose solution to drink overnight to counter the hypoglycemic shock. The development of diabetes was confirmed after 48 h of the streptozotocin injection. The rats having fasting blood glucose level more than 200 mg/dL were selected for experimentation.

Collection of blood samples and glucose determination [19, 20, 21]

Blood samples were collected by end tail vein cutting method and blood glucose level was determined by using one touch electronic glucometer.

Animal allotment [23, 24, 25]

After the induction of diabetes, the rats were divided into six groups of six animals each:

Group I: Normal control animals received 1% CMC 10 ml/kg

Group II: STZ induced diabetic animals received 1% CMC 10 ml/kg, p.o. for 21 days.

Group III: STZ induced diabetic animals received Ethanolic extract of Carallum umblleta HAW at the dose of 100 mg/kg body weight p.o. daily for 21 days.

Group IV: STZ induced diabetic animals received Ethanolic extract of Carallum umblleta HAW at the dose of 200 mg/kg body weight p.o. daily for 21 days..

Group V: STZ induced diabetic animals received Ethanolic extract of Carallum umblleta HAW at the dose of 400 mg/kg body weight p.o. daily for 21 days..

Group VI: STZ induced diabetic animals received standard drug, Glibenclamide 10 mg/kg daily p.o. for 21 days

All the group of animals received the treatment by the above schedule for 15 days. Blood samples were collected one hour after drug administration on the day 0, 5, 10, 15 and 20th day to determine the blood glucose level by electronic glucometer.

Rats were sacrificed at the end of 21st day and the blood samples were collected to analyze the effect on biochemical parameters.

Collection And Processing Of Blood For Estimation Of Glucose And Other Biochemical Parameters

Biochemical assays [1517, 18]

Fasting blood glucose level, lipid profiles and biomarkers were evaluated in normal and diabetic rats. The blood glucose level was estimated by one touch glucometer (Accu check). Serum marker such as serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and serum alkaline phosphatase (SALP) and lipid profiles were also measured. Liver glycogen level was measured according to standard method .

Statistical analysis

Data are expressed as mean ± S.E.M. Statistical comparison between groups were done by one way analysis of variance (ANOVA) followed by Tukey Kramer multiple comparison test to analyze the differences. $p<0.001$ were considered as significant.

**RESULTS**

Pharmacological studies

Antioxidant assay of the different extracts of Carallum umblleta HAW

DPPH Assay

Table (1) show the DPPH free radical scavenging effects of different successive extracts of Carallum umblleta HAW. All the tested extracts show appreciable free radical scavenging activities. Ethanolic extract has the strongest radical scavenging activity at different concentrations

Table 7: Effect of ethanolic extract of *Carallum umblleta HAW* on serum biomarkers in STZ induced diabetic rats

| Groups | SGOT ( IU / dl) | SGPT ( IU / dl) | ALP ( IU / dl) |
|---|---|---|---|
| Control | 54.83 ± 0.60 | 63 ± 0.63 | 122.66 ± 0.66 |
| STZ induced diabetic control | 147 ± 0.51[a] | 134.5 ± 0.42 [a] | 241.66 ± 0.33 [a] |
| STZ + EECU (100 mg / kg) | 107.16 ± 0.60 [a] | 103.33 ± 0.42 [a] | 206.83 ± 0.47 [a] |
| STZ + EECU (200 mg / kg ) | 94.83 ± 0.47 [a] | 87.33 ± 0.98 [a] | 184.16 ± 0.60 [a] |
| STZ + EECU (400 mg / kg ) | 75.16 ± 0.30 [a] | 77 ± 0.36 [a] | 156.16 ± 0.65 [a] |
| STZ + Glibenclamide (10 mg / kg ) | 65.66 ± 0.33 [a] | 73 ± 0.57 [a] | 131.83 ± 0.60 [a] |

*Values are diabetic control expressed as mean + SEM n=6; Data were analysed using one way ANOVA followed by Tukey-Kramer multiple comparison test; [a]p<0.001 compared to control.*

compared to other successive extracts followed by aqueous and Ethyl acetate. However n – hexane extract shows the lowest radical scavenging activity.

Effects of Various Extracts on Inhibitory Glucose Diffusion: The effect of various extracts on glucose diffusion inhibition was depicted. At the end of 27 hrs, glucose movement of control (without plant extract) in the external solution had reached a plateau with a mean glucose concentration above 300mg/dl (316.33 ± 0.88). It was evident from the graph that the ethanol extract was found to be potent inhibitor of glucose diffusion ($p<0.001$) compared to control. The ethanol extract was found to be more potent than other extracts showing the lowest mean glucose concentration of 204.66 ± 1.76 mg/dl at the end of 27 hrs (Table. 2). Thus the ethanolic extract was selected for further in vivo studies.

Acute toxicity studies: On the basis of toxicity study, it was observed that the ethanolic extracts of Carallum umblleta HAW were nontoxic and did not induce death at the highest single dose, 2000 mg/kg b.w. per oral. No toxic symptoms like behavioral changes, locomotion, convulsions etc., were observed.

Oral Glucose Tolerance Test (OGTT) in glucose induced hyperglycemic rats:

The effect of Carallum umblleta HAW extract in glucose induced hyperglycemia in normal rats shown in Table 3. The blood samples were analyzed for glucose content at 0, 30 60, 120 minutes, respectively. The blood sugar were reduced in Group II, III & IV significantly ($p<0.001$) and were comparable to normal rats and the effects were dose-dependent. It was found that extract have also hypoglycemic effect in glucose induced hyperglycemic rats.

In vivo antidiabetic activity: The blood sugar levels measured in normal and experimental rats in initial and at the 0, 5, 10 15 and 20th days of treatment are given in Table 4. Streptozotocin-induced diabetic rats showed significant increase in the levels on blood sugar as compared to normal rats. Oral administration of ethanolic extracts of Carallum umblleta HAW (100, 200 and 400 mg/kg) showed significant decrease ($p<0.001$) in blood sugar level. The standard drug, Glibenclamide decreased blood sugar level in 20 days treatment.

Biochemical analysis: The effect of Ethanolic extract of Carallum umblleta HAW (BM) on changes in plasma glucose, insulin, total hemoglobulin, glycosylated hemoglobin and liver glycogen is given in Table 5. In diabetic rats significantly (a $p < 0.001$, b $p<0.05$) decreased levels of liver glycogen, plasma insulin and total hemoglobin and increased levels of glucose and glycosylated hemoglobin was observed when compared to untreated normal rats. Oral administration of ethanolic extract of CU significantly ($p<0.001$, $p<0.05$) increased the levels of liver glycogen, plasma insulin and total hemoglobin and restored glycosylated hemoglobin to near normal level when compared to untreated normal control rats.

Glycogen level in tissue

After 21 days treatment with EECU (100, 200 and 400mg/kg), liver glycogen level (9.86 ± 0.02, 9.7 ± 0.03 and 9.21 ±0.01 respectively) was significantly increased with respect to diabetic control group (5.68±0.04) but this was not restored to the normal group glycogen level (10.48 ± 0.01).

Serum transaminase and lipid profile level : Table 6 presents the levels of serum lipids in normal and in diabetic rats. Total cholesterol, triglycerides and LDL cholesterol levels were significantly ($p<0.001$) increased in diabetic rats with significant decrease in HDL cholesterol level when compared to untreated control rats. Oral administration of ethanolic extract of BM had significant ($p< 0.001$) effect in restoring the levels of serum lipids to near normal level with mild increase in HDL cholesterol level.

After 21 days experiment, serum transaminase such as SGOT, SGPT, and SALP activity was significantly elevated in the diabetic control groups. After supplementation with EECU (100, 200 and 400mg/kg) and glibenclamide the serum transaminase level was resettled to normal level (Table 7).

## DISCUSSION

The results of antioxidants effect of various solvent extracts of Carallum umblleta HAW, showed the conversion of the DPPH (1, 1-diphenyl-2- picryl hydrazine) in to diphenyl picryl hydrazine. The absorbance values of the ethanolic extracts of leaves were found to be higher than the other extracts by that it shows high free radical scavenging activity.

Over 400 plants have been documented as being useful for control of blood glucose concentration; however, the majority of these plants have yet to be scientifically or medically evaluated.A simple in vitro dialysis-based model was used to investigate how various solvent extracts of Carallum umblleta HAW that exhibit antidiabetic properties as dietary supplements affect glucose diffusion. The experiment showed that Glucose Tolerance Test (OGTT) measures the body ability to use glucose, the body's main source of energy. This test can be used to diagnose pre-diabetes and diabetes. Glucose lowering effects were found after oral administration of ethanolic extracts in rats.

STZ is a nitrosurea compound produced by Streptomyces achromogenes, which specifically induces DNA strand breakage in β-cells causing diabetes mellitus. Therefore, the STZ-diabetic model has been widely employed to induce diabetes in experimental animals.

Streptozocin selectively destroyed the pancreatic insulin secreting β cells, leaving less active cell resulting in a diabetic state. The test samples might possess glibenclamide like effect on peripheral tissues either by promoting glucose uptake and metabolism or inhibiting hepatic gluconeogenesis.

Elevation of biomarker enzymes such as SGOT, SGPT and SALP was observed in diabetic rats and indicates the hepatic damage. The decreased total protein substantiates the hepatic damage by STZ. The diabetic complications such as increased gluconeogenesis and ketogenesis may be due to elevated transaminase activity. The hepatic damage was restored; hepatocytes and the elevated transaminase activities were significantly reduced by test drug treatment. From this view Carallum umblleta HAW may acts as a hepatoprotective agent. It is well known that in uncontrolled diabetes mellitus, there will be an increase in total cholesterol, triglycerides and LDL cholesterol associated with decrease in HDL cholesterol and contribute to coronary artery disease.

In the present study the total cholesterol, triglycerides and LDL cholesterol was increased in diabetic control groups and it was reduced in 21 days treatment with Carallum umblleta HAW as well as the HDL cholesterol level was significantly increased.

This suggests that the extract may inhibit the pathway of cholesterol synthesis and increased HDL/LDL ratio may be due to the activation of LDL receptors in hepatocyte, which is responsible for taken up LDL into the liver and reduce the serum LDL level.

## CONCLUSION

In conclusion, the medicinal herbs belonging to the family Acanthaceae are rich sources of antioxidants. The Carallum umblleta HAW significantly improve the free radical scavenging and provides hints for using as an antidiabetic. The present study clearly indicated the use of this plant as antidiabetic agents. We believe that this plant may play vital role in future studies on determining the mechanisms of its anti hyperglycemic activity, as well as for the isolation and identification of active anti hyperglycemic substances. The results of the study strongly suggest that ethanolic extract of Carallum umblleta HAW is useful in the treatment of Diabetes mellitus. In addition, further comprehensive pharmacological investigations related to the mechanism of action will be carried out to assess the likely therapeutic effect of this anti diabetic plant.

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