Ameliorative potential of aqueous extract of *Talinum triangulare* on diabetes associated metabolic alterations.

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Abstract

Oral administration of aqueous extract of *Talinum triangulare* to diabetic rats secluded the rats from the alterations induced in carbohydrate and lipid metabolism. The raise in the glycosylated hemoglobin is a sign of succession in diabetes. In addition, during diabetes there is an increase in the cholesterol and triglyceride contents. The Supplementation of *Talinum triangulare* leaf aqueous extract (80mg/kg *b.wt*) brought the levels of lipids to almost normal by exhibiting antihypoglycemic and antilipidemic properties. The decrease in HDL cholesterol in diabetic rats can be used as a marker in the assessing the severity of diabetes.

Key words: *Talinum triangulare* , Hemoglobin, Glucose levels, Sugar, Lipid profile

1. Introduction

Diabetes mellitus is found in all parts of the world and fast increasing worldwide. This disease is quite alarming in most of the developing countries including India. India has more than 40 million diabetic individuals which represents nearly 20 % of total diabetes population worldwide. Many of the presently available antidiabetic agents have number of unfavorable effects on the body (Jung *et al*., 2006). Therefore, supervision of diabetes without any side effects is still a difficult task for health care providers (Saxena & Kishore, 2004). Hence, the search for more successful and safer hypoglycemic agents with lesser side effects has continued to be a significant area of investigation. Numerous diabetes associated metabolic alterations are reported (Kostner & Karadi, 1998; Szaleczky *et al*., 1999; Chandalia & Lamda, 2002). Even though antidiabetic action of crude extracts and purified active constituents of many plants are identified, studies related to the curative activity of medicinal plants with reference to the diabetes associated altered metabolic functions are very scanty. Therefore in this investigation *Talinum triangulare* has been chosen to study the crude extract effect in the restoration of enzyme activities related to the carbohydrate metabolism in STZ- induced metabolic alterations in diabetic albino rats.

2. Materials and methods

2.1 Animals

Male albino rats (Wistar strain, weighing 150-200g) were purchased from Tamil Nadu Veterinary Animal Science University, Madhavaram, Chennai and housed under standard husbandry conditions (30ºC ± 2ºC, 60-70 % relative humidity and 12hr day night cycle) and allowed standard pelleted rat feed and water *ad libitum*. Animal experiments were designed and conducted in accordance with the guidelines ofInstitutional Animal Ethical Committee (Sri Venkateswara University, Thirupati).

2.2 Plant material and extract preparation

The *Talinum triangulare* leaves were harvested and shade dried for 20 days. Then grinded mechanically and 100g of coarse powder was extracted by using water in soxhlet apparatus. Extract was concentrated to semi-solid water free material and final extract yield was 8.5%.

2.3 Induction of diabetes mellitus in rats

Diabetes was developed by injecting Streptozotocin (STZ) (Sigma, USA) at a dose of 35 mg/kg body weight (b/w) in

0.1 M cold citrate buffer of pH 4.5, interaperitoneally. STZ injected animals exhibited severe glycosuria and hyperglycemia and rats were stabilized over a period of 7 days (Sarkar *et al*.,1996). Diabetes was confirmed in the overnight fasted rats by measuring blood glucose concentration 96 hr after injection with STZ. The rats with blood glucose above 250 mg/dL were considered to be diabetic and used for the experiment. Control rats were given citrate buffer (pH 4.5).

2.4 Experimental design

Animals were divided in to six groups of six animals each. Group I served as a control: group II had normal + **TT**(40 mg/ kg bw) rats; group III had normal + **TT** (80 mg/kg bw) and Group IV acts as diabetic control, V as diabetic + **TT** (40 mg/ kg bw) and VI comprised the diabetic + **TT**(80 mg/kg bw) rats treated with *talinum triangulare* aqueous leaves extract 40 and 80 mg/Kg bw/day respectively for 6 weeks, by oral incubation method. Rats were sacrificed at the end of 6 weeks and the blood samples were collected to analyze the effect of TT on biochemical parameters. Collection and processing of blood for estimation of glucose and other biochemical parameters. Total hemoglobin was estimated by the cynomethaemoglobin method (Drabkin and Austin, 1932) and glycosylated hemoglobin (HbA1C) was estimated by the method (Nayak & Pattabiraman, 1981; Bannon, 1982). Serum total cholesterol, triglycerides and serum HDL-cholesterol were using commercial kits (Dialab, Austria).

2.5 Toxicity studies

The aqueous extract was administered orally to different groups of rats (n=6) in doses ranging from 100 mg-1g/kg of *b.wt*/day to 2-5g/kg of *b.wt*/day. The rats were observed for any lethal effects.

2.6 Statistical analysis

Statistical analysis was performed using the SPSS software package, version 9.05. The values were analyzed by one way analysis of variance (ANOVA) followed by Duncan's multiple range test (DMART). All the results were expressed as mean ± SD for six rats in each group and $p<0.05$ was considered as significant.

2.7 Results

The yield of aqueous extract of TT was found to be 8.5 % (w/v). The TT extract treated rats appeared as normal. No toxic effect was reported with the effective dose of aqueous extract and there were no death in all the groups. The application of aqueous extract of TT on the change of body weight, plasma glucose, hemoglobin and glycosylated hemoglobin is mentioned in Table 1 and Table 2. In diabetic rats there are significant decrease in the levels of glycogen and glycosylated hemoglobin was observed when compared to the untreated normal rats Oral administration of aqueous extract of TT significantly increased the levels of glycogen and restored the normal levels of glycosylated hemoglobin in diabetic treated rats. In Table 2 and 3 serum lipids of normal and diabetic rats were mentioned. Total cholesterol, triglycerides and LDL cholesterol levels were significantly increased in diabetic rats with significant decrease of HDL cholesterol levels in comparison with untreated control rats. Oral administration of aqueous extract of TT showed significant effect in the restoration of the normal levels of above mentioned lipids. Thus TT aqueous extract is able to protect the system from diabetic induced damage by altering both carbohydrate and lipid metabolism.

Table 1. *Effect of Talinum triangulare (TT) leaf extract (40 and 80 mg/kg bw) on glucose and changes of body weight in control and Alloxan- diabetic rats.*

Group	Glucose mg/dl	Change in Body weight (gms)
Control	72±7.8	+24.1±5.3
Normal + TT (40 mg/kg bw)	84±7.9	+24.1±4.4
Normal + TT (80 mg/kg bw)	77±7.2	+26.2±5.5
Diabetic control	211±13.2	-25.0±8.2
Diabetic + TT (40 mg/kg bw)	96±8.2	-11.5±7.5
Diabetic + TT (80 mg/kg bw)	98±8.4	-8.±7.3
Each value is mean ± SD for 6 rats in each group. a: $p<0.05$ by comparison with normal rats. b: $p<0.05$ by comparison with alloxan diabetic rats. - : No significance.		

Table 2. *Effect of Talinum triangulare (TT) leaf extract on Hemoglobin (Hb), Glycosylated hemoglobin (HbA1C), and Hepatic glycogen levels in control and alloxan – diabetic rats.*

Groups	Hb(mg/dl)	HbA1C(mg/g of Hb)	Hepatic Glycogen (gm/100g wet tissue)
Normal	15.1±1.11	0.62±0.06	4.18±0.30
Normal + TT (40 mg/kg bw)	13.9±1.05[b]	0.51±0.02 [b]	4.02±0.31[b]
Normal + TT (80 mg/kg bw)	13.7±1.06[b]	0.48±0.03[b]	4.19±0.33[b]
Diabetic control	6.0±0.51[a]	1.22±0.08[b]	1.32±0.09[b]
Diabetic + TT(40 mg/kg bw)	14.2±1.04[b]	0.56±0.05[b]	3.82±0.31[b]
Diabetic + TT (80 mg/kg bw)	13.9±1.06[b]	0.62±0.03A[b]	3.56±0.34[b]

Each value is mean ± SD for 6 rats in each group.
a: p<0.05 by comparison with normal rats.
b: p<0.05 by comparison with alloxan diabetic rats.
- : No significance.

Table 3. *Effect of Talinum triangulare (TT) leaf extract on tissue total cholesterol levels in control and Alloxan-diabetic rats.*

Groups	Total cholesterol (mg/g wet tissue)	
	Liver cholesterol	Triglycerides
Normal	7.12±0.61	6.12±0.54
Normal + TT (40 mg/kg bw)	6.75±0.56 b	6.01±0.52 b
Normal + TT (80 mg/kg bw)	6.17±0.61 b	6.22±0.49 b
Diabetic control	15.12±1.07 a	13.78±1.01 a
Diabetic + TT(40 mg/kg bw)	8.13±0.61 b	8.12±0.69 b
Diabetic + TT (80 mg/kg bw)	7.84±0.57 b	7.88±0.58 b

Table 4. *Effect of Talinum triangulare (TT) leaf extract on serum HDL, LDL and VLDL levels in control and Alloxan -diabetic rats.*

Groups	Total cholesterol (mg/g wet tissue)	
	Liver cholesterol	Triglycerides
Normal	7.12±0.61	6.12±0.54
Normal + TT (40 mg/kg bw)	6.75±0.56[b]	6.01±0.52 [b]
Normal + TT (80 mg/kg bw)	6.17±0.61[b]	6.22±0.49[b]
Diabetic control	15.12±1.07 [a]	13.78±1.01[a]
Diabetic + TT(40 mg/kg bw)	8.13±0.61[b]	8.12±0.69[b]
Diabetic + TT (80 mg/kg bw)	7.84±0.57[b]	7.88±0.58[b]

Each value is mean ± SD for 6 rats in each group.
a: p<0.05 by comparison with normal rats.
b: p<0.05 by comparison with alloxan diabetic rats.
- : No significance.

3. Discussion

The present investigation was to evaluate the efficiency of the aqueous extract of TT on STZ-induced metabolic changes diabetic rats. Decreased Hb content was observed in diabetic rates might be due to increased formation of glycosalated Hb. Generally total hemoglobin levels is much below the normal levels in diabetic subject (Chandalia & Krishnaswamy, 2002)

and HbA1c levels has been reported to be increased in patients with diabetes mellitus (Paulsen, 1973). It was reported that during diabetes mellitus, the excess of glucose present in the blood reacts with hemoglobin to form HbA1C (Koening *et al.,* 1976). The levels of HbA1C are always monitored as a reliable index of glycemic control in diabetes (Gabbay, 1976). Elevated levels of HbA1C and reduced levels of Hb observed in our study reveals that diabetes animals had prior high blood glucose levels. Administration of aqueous extract of TT extract (40 mg/ Kgbw/day) had brought back the elevated HbA1C levels to near normal levels. It has already been reported that decreased liver glycogen content was due to insulin deficiency and associated glycogenolysis process (Vats *et al*., 2004). The possibility of restoration of glycogen content in STZ-induced diabetic rats by the administration of TT aqueous extract may be due to increased insulin secretion and reactivation of glycogen synthase enzyme system. Hypercholesterolemia and hypertriglyceridemia in STZ- induced diabetic rats are well documented Insulin deficiency leads to increased serum lipids because of increased lipolysis (Shirwaikar *et al*., 2004) .The elevated levels of serum total cholesterol, triglycerides and LDL cholesterol were significantly decreased after treatment with TT leaves Extract. Similar findings were also reported with the methanolic extract of the TT (Ravindra Babu *et al*., 2012).

4. Conclusion

From this study it can be concluded that the administration of aqueous extract of TT aqueous extract is beneficial in normalizing the alterations in carbohydrate metabolism during diabetes.

5. References

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