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Comparative Study of *Teramnus labialis* and *Xanthium strumarium* for Anti-Diabetic Property

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Abstract

Introduction: Plants have always been a very good source of drugs. Diabetes mellitus (DM) is one of the common metabolic disorders acquiring around 2.8% of the world's population. Hence in the present study, we intend to evaluate the antidiabetic property of the *Teramnus labialis*, *Xanthium strumarium*. **Materials and Methods:** T. labialis, Methyl extract *Teramnus labialis* (METL) and *X. strumarium* Methyl extract *Xanthium strumarium* (MEXS) were collected from hills of Tirupathi, dried, and powdered. Healthy male Wistar albino rats induced DM with the Streptozotocin-Nicotinamide and Alloxan induced model were studied on days 1, 7, 14, 21, 28 for the serum glucose (SG), total cholesterol, triglycerides, high-density lipoprotein and low-density lipoprotein levels. The observations were compared with the standard drugs Glibenclamide. **Results:** When extracts administered at low dose in combination exhibited a valuable synergistic activity on mean blood glucose levels, which were almost similar when these results compared with that of standard drug-treated animals. **Conclusion:** Both the plant extracts were safe in the combination and do not shown any toxicities or drug-related interactions but future pharmacokinetic studies required to validate the given result.

Keywords: Anti-diabetic property, *Teramnus labialis*, *Xanthium strumarium*

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Introduction

Diabetes mellitus (DM), one of the most common endocrine metabolic disorders has caused significant morbidity and mortality due to microvascular (retinopathy, neuropathy, and nephropathy) and macrovascular (heart attack, stroke, and peripheral vascular disease) complications.[1] Human bodies possess enzymatic and non-enzymatic antioxidative mechanisms which minimize the generation of reactive oxygen species, responsible for many degenerative diseases including diabetes.[2] The disease is rapidly increasing worldwide and affecting all parts of the world. Due to deficiency of the insulin people suffering from diabetes have high blood glucose level.[3] Type 2 diabetes or noninsulin-dependent DM, is the most common form of the disease, accounting for 90–95% of cases in which the body does not produce enough insulin or properly use it.[4] According to the World Health Organization the diabetic population is likely to increase up to 300 million or more by the year 2025.[5] Currently available therapies for diabetes include insulin and various oral antidiabetic agents such as sulfonylureas, biguanides, and glinides. However, they have noted side effects. Plants have always been a very good source of drugs and many of the currently available drugs have been derived directly or indirectly from them. Hence in the present study, we intend to evaluate the antidiabetic property of the *Teramnus labialis*, *Xanthium strumarium*.

Materials and Methods

Collection of Plant and Plant Material

Both the plants were collected from the hilly areas of Tirupati, the collected plant materials were subjected for cleaning and drying, later mechanical grinding procedures were used to give powder plant material. These collected powder materials were subjected for preliminary phytochemical analysis where all the plant materials were extracted with solvent alcohol then the extracts were used for phytochemical screening to reveal the presence of type of phytochemical present in the selected plant extracts. Later these extracts were further used for pharmacological investigation. The selected extracts were also used for the evaluation of total flavonoids content and phenolic content.

The alcoholic extracts of both the selected plants were evaluated for the gross behavioral and acute toxicity studies on Swiss albino mice by following guidelines provided by Organisation for Economic Co-operation and Development. These results revels that both the extracts were safe even at the highest dose 2000 mg/kg based on this 1/10th of safe dose, one submaximal dose and one supramaximal doses were selected to carry out pharmacological screening for their unexplored folklore claims by using selected *in vivo* pharmacological methods or animal models.

Source of Animals

Healthy male Wistar albino rats (150–180 g) of age 8–10 weeks were obtained from Hyderabad. The experiments and procedures used in study were approved by the Institutional Animal Ethics committee.[6,7]

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Statistical Analysis

For each set of experiments where two or more than two groups were compared, an analysis of variance (ANOVA) test was used to determine the significance of differences. Statistical analysis was done by one-way ANOVA followed by Dunnett's post analysis using Graph pad prism version 5.0, USA. All the values were presented as mean ± SEM. The significance of the difference between averages was determined and the data obtained from the present study was analyzed for *P*-value. A $P < 0.05$ was taken as the criterion of significance and $P < 0.001$ was considered highly significant.

Results

Effect on Blood Glucose Levels

It clearly observed that serum glucose levels were partly elevated in normal control group (Figures 1-5 and Tables 1-3), whereas a constant rise was detected in the average serum glucose levels animals present in diabetes control group which received Streptozotocin-Nicotinamide (STZ-NCT) as an inducing agent. The animals under standard group, which receives drug Glibenclamide at a dose of 10 mg/kg weight observed the statistically significant deployment in the boosted blood glucose levels at 28th days of the study, whereas there was a little deployment in the average serum glucose levels observed at 7th, 14th, and 21st days of the study, but these values were not too significant in nature. Animals in low dose treated group deployed the mean plasma glucose levels but these valves were not considerable when the mean sugar levels, which were observed in medial and high dose treated experimental animals, but the serum glucose values were most statistically significant in animals which received high treatment doses for all 28 days. The mean plasma glucose levels in the same group animals were also declined in initial days but not up to the mark of significant or normal ranges.

When extracts administered at low dose in combination exhibited a valuable synergistic activity on mean blood glucose levels, which were almost similar when these results compared with that of standard drug treated animals.

Discussion

In the present day-specific targeted and poor linking situations; ethnopharmacology and drugs from natural vegetative sources preserve crucial matter, for instance several existing drugs demolish their beginning in ethnopharmacology. At present, there is a practical partiality with respect to ancient traditional and integrated health disciplines in research and practice coupled together. The natural and unadventurous stream in treatment journeying is ephemeral away from introverted molecule or solitary target style to amalgamations and copious target lines.[8,9]

Specific solvent extraction of selected plant powder results into plant extract with notable chemical secondary metabolites which possesses the wide number of pharmacological activities which were presently used to treatment various illness of the population.

A resinous greenish extract was obtained and which were stored in desiccators for the completion of the study.

The extracts of selected plants did not show any noxious or injurious impermanence up to 2000 mg/kg body weight by the oral route of administration, so all extracts were reflected in

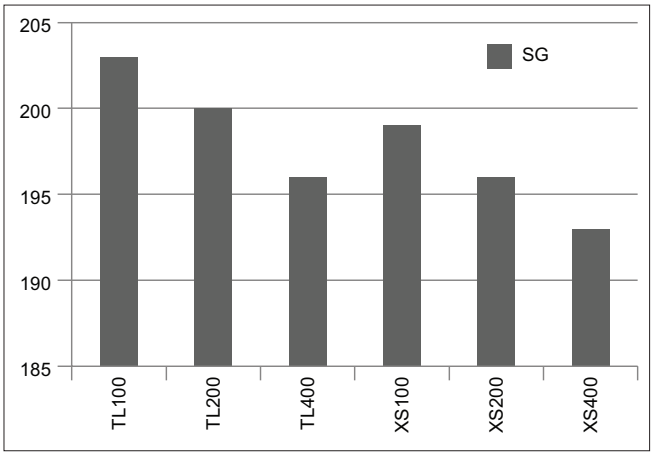

Figure 1: SG of TL and XS of day 1

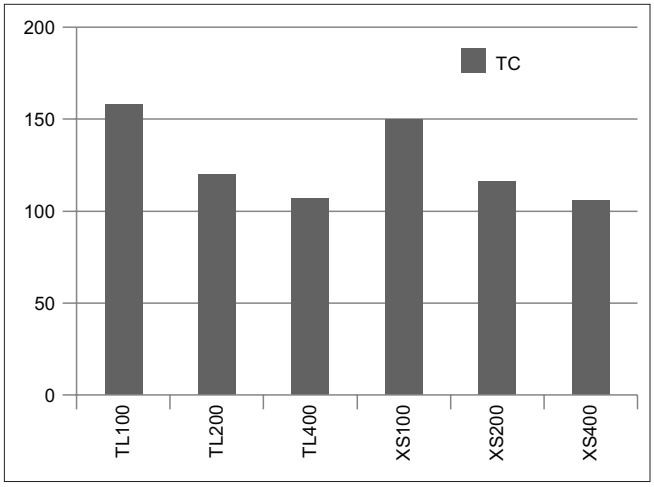

Figure 2: Total cholesterol of TL and XS of day 1

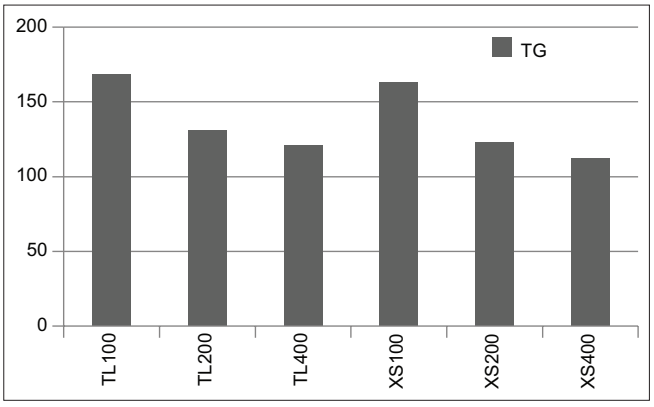

Figure 3: Triglycerides of TL and XS of day 1

category No. 5. the known behavioral signs such as change in skin color or texture, hair, eye movement, mucous secretions, breathing, autonomic symptoms, central nervous system changes, communicating variations, body jerks or movements, diarrhea, lassitude, and snooze were taken into the consideration. The onset of above said considerations and any type of obnoxious injuries

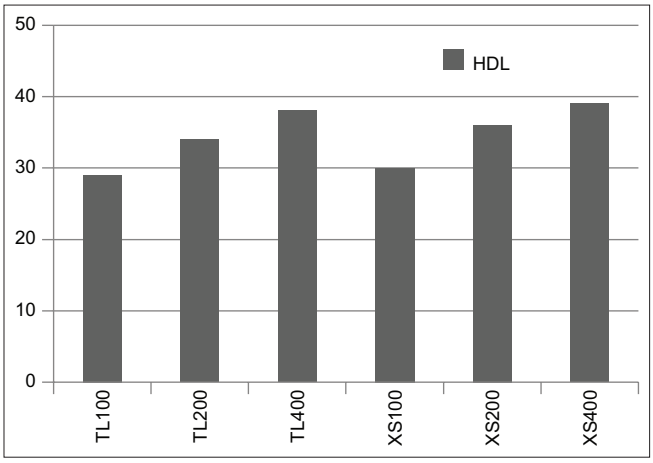

Figure 4: High-density lipoprotein of TL and XS of day 1

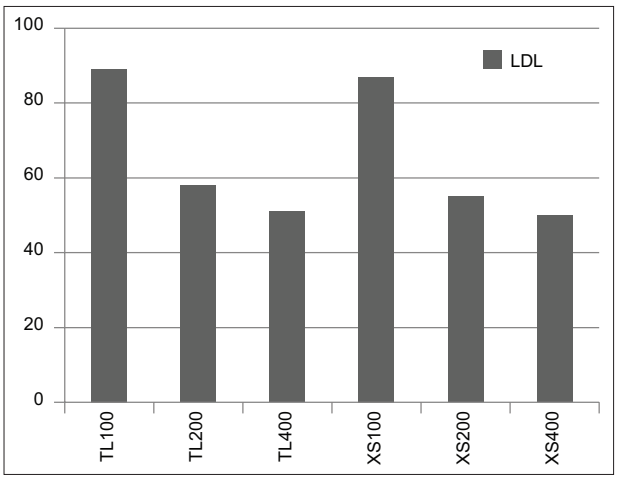

Figure 5: Low-density lipoprotein of TL and XS of day 1

were absent for next 3 days which will be consider as toxicity surveillance period. The absence of above signs indicates safe and harmlessness of all the selected plant extracts. Based on this toxicity study 1/10th of safe dose was taken as medial dose and other two were one submaximal and supramaximal doses for investigation of desired pharmacological activity.

With current day medication, no considerable effective treatment is still available to regulate DM. Injections of currently existing treatments like insulin and oral hypoglycemic agents were used as a single or in the form of combinational therapeutical approach to overcome raising or improved blood glucose levels in the human body. The use of above said drugs or treatment methods carry numerous and serious adverse effects in the human system because of multiple effects possessed by the administered drugs. As a result of the above, there is an increase in demand or claim for the identification of novel therapeutic approaches which includes introduction of novel oral anti-diabetic agents. The management of diabetes dispossessed of any side effect is an encounter to the system of medicine.

Plant was considered a chief components and they have a important play role in the identification of novel anti-diabetic agents and the valuable manifold happenings reminiscent of manipulating carbohydrate metabolism by several mechanisms, avoiding, reestablishing neatness and role of cells, insulin emancipating activity, informative glucose uptake and usage, anti-oxidant and free radical scavenging activities in plant-based medicines, suggests the invigorating prospect to advance them into innovative therapeutic approaches.[10,11]

After conducting the research, an elevated serum glucose levels accompanied by increase in total cholesterol, triglycerides, low-density lipoprotein-cholesterol, very low density lipoprotein-cholesterol and decreased in high-density lipoprotein cholesterol in the STZ-NCT induced DM rats was observed as compared to normal control animals. The oral administration of ethanolic extract for 28 days at high doses normalized the levels of blood

Table 1: Antidiabetic activities day 7

Day-7					
Group	*SG*	*TC*	*TG*	*HDL*	*LDL*
Test-1					
100	190.54±3.26	154.54±2.66	162.13±3.89	30.16±1.33	85.12±1.65
200	*178.11±4.08	117.12±2.48	126.22±2.76	35.13±1.39	54.32±1.13
400	169.21±3.78	103.05±2.32	116.21±2.56	39.07±1.22	47.07±0.89
Test-2					
100	185.22±3.24	145.61±3.71	156.18±3.87	31.56±1.09	83.05±1.99
200	170.54±2.29	111.05±3.21	118.54±3.19	*38.03±0.91	51.54±1.84
400	161.44±2.19	100.22±3.01	107.15±3.06	40.12±0.72	46.12±1.71

n=6, mean±SEM (>0.005). TC: Total cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 2: Antidiabetic activity Alloxan induced model Day 1

Day-1					
Group	*SG*	*TC*	*TG*	*HDL*	*LDL*
Test-1					
100	111.28±5.8	130.21±7.12	158.21±4.98	*24.14±1.22	68.26±4.53
200	109.22±5.3	120.65±6.89	119.19±4.69	27.55±1.38	60.15±4.34
400	106.43±4.8	113.54±6.77	*114.52±4.34	29.12±1.45	58.65±3.88
Test-2					
100	109.34±3.2	*122.37±5.67	152.16±4.43	37.87±1.09	64.19±3.79
200	104.21±2.9	116.32±5.43	113.29±4.29	38.72±1.16	56.82±3.65
400	103.33±2.1	110.21±5.21	110.33±4.16	40.18±1.22	54.32±3.53

n=6, mean±SEM (>0.005). TC: Total cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 3: Antidiabetic activities Day 7

Day-7					
Group	*SG*	*TC*	*TG*	*HDL*	*LDL*
Test-1					
100	109.25±6.9	128.65±6.97	156.54±4.88	*25.17±1.49	*66.23±4.09
200	107.24±3.1	118.21±6.76	117.45±4.67	28.54±1.51	58.33±3.89
400	104.43±2.8	111.43±6.54	112.14±4.56	30.21±1.62	56.65±3.77
Test-2					
100	106.21±2.8	120.32±4.96	149.45±4.21	38.12±1.11	62.15±3.65
200	103.32±2.4	114.26±4.76	*111.87±4.11	39.32±1.21	54.76±3.54
400	101.63±2.1	107.66±4.43	108.23±3.89	41.82±1.32	52.19±3.45

n=6, mean±SEM (>0.005). TC: Total cholesterol, TG: Triglycerides, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

glucose when compared with that of standard drug-treated animals, whereas reduction in blood glucose levels were observed only at the 28th day of the study not at early days. The potent or strong anti-diabetic efficacy of the plant extracts and formulated compound suggested that the presence of potent anti-diabetic active principles compounds such as alkaloids, flavonoids found in the prepared extract the same was observed or it is clear by preliminary phytochemical screening by which the exacts were produced anti-diabetic activity.[12,13]

When extracts were administered in the form of combination it was showed a potent synergistic activity on serum glucose levels of the treated animals and which were particularly similar to that of standard also. So it is clear indication that both the plant extracts were safe to use them as a drug in alone as well as in combination and it is also evident that extract in combination not possesses any toxic or drug-related interactions but there is a need to generate pharmacokinetic data to prove the statements.[14,15]

Conclusion

Both the plants showed significant anti-diabetic properties. The study also can be extended to work on the development and evaluation of suitable dosage forms for diabetes treatment with these identified herbs individually and also in their amalgamation to corroborate the synergistic mechanisms and pharmacokinetic studies.

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