



## Research article

## Hypoglycemic and antihyperglycemic effect of different extracts of *acacia arabica lamk* bark in normal and alloxan induced diabetic rats

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### Abstract

*Acacia arabica* commonly known as babool are used in traditional Indian medicine for treatment of diabetes mellitus. The hypoglycemic effect of aqueous extract (hot and cold water) and hydroalcoholic extract of *Acacia arabica* was investigated. Oral administration of cold water extract of *Acacia arabica* bark to diabetic and normal rats at a dose of 400 mg/kg body weight resulted in significant reduction of blood glucose, cholesterol and triglycerides. Phytochemical investigations found that phenolic compounds are presents in *Acacia arabica* extracts. The cold water extract of *Acacia arabica* was found to reduce blood glucose level to its normal level with in seven days. Histological studies of the  $\beta$ -cells show its action on pancreas.

**Keywords:** Diabetes, antidiabetics, *Acacia arabica* and babool.

### Introduction

Diabetes mellitus is caused by an absolute or relative lack of insulin that among other consequences, leads to an increase in plasma glucose concentration. In type I insulin-dependent diabetes mellitus [IDDM], previously called juvenile diabetes; there is an absolute lack of insulin. The condition is caused by a lesion in the beta cells of Islets of langerance, it is projected to become one of the world's main disablers. Regions with greatest potential are Asia and Africa, where Diabetes mellitus rates could rise to two –three folds than the present rates. Apart from currently available therapeutic options, many herbal medicines have been

recommended for the treatment of diabetes. Traditional plant medicines are used throughout the world for a range of diabetic presentations [1] the phytochemical investigation shows the presence of Saponins, Alkaloids, Flavonoids and Tannins. Hyperglycemia results in the generation of free radicals which can exhaust antioxidant defenses thus leading to the disruption of cellular functions, oxidative damage to membranes and enhanced susceptibility to lipid peroxidation [2,3]. Flavonoids are one of the most numerous and widespread group of phenolics in higher plants [4,5,6,7]. Some of them, due to their phenolic structure, are known to be involved in the healing process of free radical-mediated diseases including diabetes [8]. Some of these are

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reported to be hypoglycemic in some literature. *Acacia arabica* belongs to family Mimosaceae and is reported for *In vitro* antibacterial activity [9] antimicrobial and immunomodulatory activities (Choubey, *et al.*, 2003). Flavonoids, sterols/triterpenoids, alkaloids and phenolics are known to be bioactive antidiabetic principles [10, 11]. Flavonoids are known to regenerate the damaged beta cells in the alloxan diabetic rats [12]. Phenolics are found to be effective antihyperglycemic agents [13]. In the present study Hypoglycemic and antihyperglycemic activity of different extract of *Acacia arabica* was observed.

#### **Materials and methods:**

##### **Plant material**

*Acacia arabica* bark was collected from the village Garhpehra near Sagar (M.P.) and identified by Dr. Pradeep Tiwari, Department of Botany, Dr Hari Singh Gour Vishwavidyalaya, Sagar. Herbarium has been deposited in Department of Botany and accession numbers of the herbs is: Bot/H/2698

##### **Preparation of extracts**

**Hydro alcoholic extract:-** The dried *Acacia arabica* bark were finely powdered and extracted by using Soxhlet apparatus. Solvent used is 50% methanol, after extraction the extract was dried. (Yield 25.544%).

**Hot water extract:-** The *Acacia arabica* bark were powdered and extracted by boiling with water for 2 hr. After extraction the extract was dried. (Yield 9.926%).

**Cold water extract:-** The dried *Acacia arabica* were powdered and extracted by macerating with water for five days. After extraction the extract is lyophilized. (Yield 14.028%).

##### **Animals**

Albino rats of Wistar strain (120-150g) of either sex were obtained from CRC BRNCP Mandasaur (M.P.). Before and during the experiment; rats were fed with standard diet (Lipton India Ltd). After randomization into various groups, the rats were acclimatized for a period of 7 days under standard environmental conditions of temperature, relative humidity, and dark/light

cycle. Animals described as fasting were deprived of food and water for 16 h *ad libitum*.

##### **Sample collection:**

Blood samples were collected from tail vein and blood glucose were estimated using electronic glucometer (Smart Care, Taiwan).

##### **Preliminary oral LD<sub>50</sub> determination:**

Preliminary oral LD<sub>50</sub> dose of AAHAE, AAHWE, AACWE; in rats were found to be 2000mg/kg. 1/5<sup>th</sup> of LD<sub>50</sub> doses of all extract 400mg/kg were used in experiment, were as that of AAHAE dose was taken as 196mg/kg due to some toxicity.

##### **Experimental design:**

All the animals were divided into the six groups with five animals in each group.

Group I: Normal control.

Group II: Diabetic control.

Group III: standard drug.

Group IV: Treated with AAHAE

Group V: Treated with AAHWE.

Group VI: Treated with AACWE.

##### **Assessment of extracts on glucose level of normal animals:**

Rats were divided in different groups and their normal glucose levels were determined with the help of glucometer, different doses of extract was administered with the help of oral feeding tube and the glucose level was determined at different time interval i.e. 60, 120, 150, 180 mins.

##### **Assessment of extracts on alloxan-induced Diabetic animals:**

Rats were made diabetic by a single intraperitoneal injection of alloxan monohydrate 150 mg/kg [14]. Alloxan was first weighed individually for each animal according to the weight and then solubilized with 0.2 ml saline just prior to injection. Two days after alloxan injection, rats with plasma glucose levels of >140 mg/dl were included in the study. Treatment with plant extracts was started 48 h after alloxan injection. Fasting blood glucose estimation and body weight measurement were done on day 1, 7<sup>th</sup> of the study. On day 7<sup>th</sup> blood was collected by cardiac puncture under mild ether anesthesia from overnight fasted rats and fasting blood sugar [15] was estimated. Serum was separated and

analyzed for serum cholesterol [16], serum creatinine [17]. The whole pancreas from each animal was removed after sacrificing the animal and was collected in 10% formalin solution, and processed for histological examination.

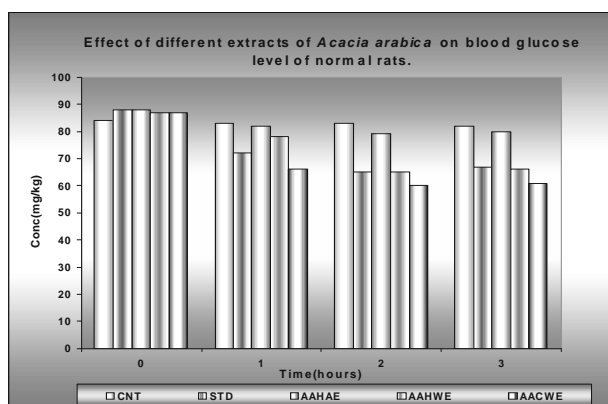
**Statistical analysis:**

All the values of fasting blood sugar, and Biochemical estimations were expressed as mean±standard error of means (S.E.M.) and analyzed for ANOVA and Dunnett’s t-test. Differences between groups were considered significant at P < 0.05 levels.

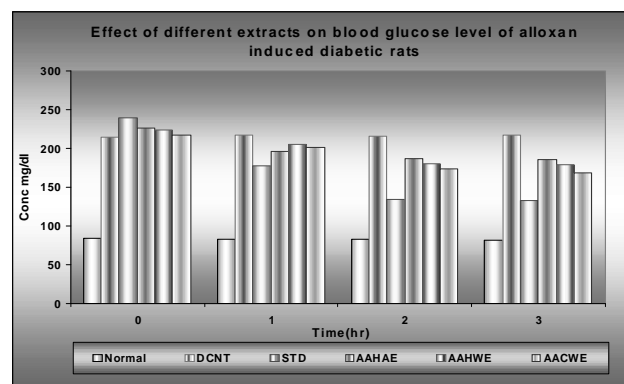
**Results and discussion**

**Result of *Acacia arabica* extracts:**

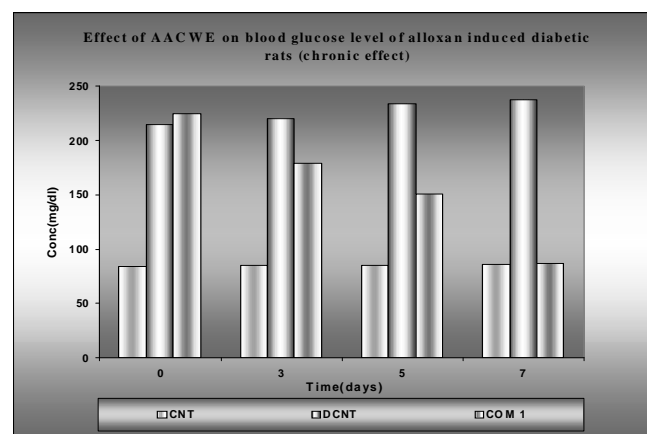
Alloxan is cytotoxic to the pancreatic β- cells thus it is an effective diabetes-induction agent. It



**Fig 1** Effect of different extracts of *Acacia arabica* on blood glucose level of normal rats.



**Fig: 2** Effect of different extracts of *Acacia arabica* on blood glucose level of alloxan induced diabetic rats.



**Fig: 3** Effect of AACWE on blood glucose level of alloxan induced diabetic rats (Chronic effect)

**Table 1: Effect of different extracts of *Acacia arabica* on blood glucose level of normal rats.**

Group No	Treat-ments	Dose mg/kg p.o	0 min	60 min	120 min	180 min
I	control	5 ml	84.00±2.14	83.80±1.96	83.00±1.76	82.20±1.68
II	drug	10	88.00±0.71	72.40±0.92**	65.80±1.28**	67.21±0.86**
III	AAHAE	196	88.6±0.88	82.61±1.54*	79.0±2.08**	80±0.54**
IV	AAHWE	400	87.12±1.52	78.33±0.33**	65.67±0.88**	66.0±0.57**
V	AACWE	400	87.00±1.14	66.81±2.70**	60.60±2.54**	61.20±1.81**

Values are given in average body weight (g) ±SEM for groups of five animals each. Vehicle (Tween 80) Diabetic control 150mg/kg b. w. dose. (Alloxan)

\*P < 0.05 as compared to vehicle control. \*\*P<0.01as compared to normal

has been widely used to induce diabetes mellitus in experimental animal models allowing

investigation of hypoglycemic agents in the treatment of diabetes [18,19]. Alloxan

**Table 2: Effect of different extracts of *Acacia arabica* on blood glucose level of alloxan induced diabetic rats.**

Group No	Treatments	Dose mg/kg p.o	0 min	60 min	120 min	180 min
I	<b>Normal control</b>	5 ml	84.00±2.14	83.80±1.96	83.00±1.76	82.20±1.68
II	<b>Diabetic control</b>	5 ml	215.20±4.18	217.00±3.61	216.80±3.45	217.60±4.54
III	<b>Standard drug</b>	10	240.41±3.81	178.2. ±4.9**	134.2±4.41**	133.0±3.22**
IV	<b>AAHAE</b>	196	227.±5.41	205.81±5.67*	187.40±4.49**	185.6±3.23**
V	<b>AAHWE.</b>	400	224.6±3.28	197.2±6.93**	180.2±5.39**	179±5.76**
VI	<b>AACWE.</b>	400	218.8±3.41	201.0±5.9*	174.80±2.87**	169.20±4.22**

injection consistently produced symptoms characteristic of diabetes mellitus including hyperglycemia, decreased insulin levels, polyurea and weight loss. In our approach, we

from *Acacia arabica bark* was evaluated in normal and alloxan-induced diabetic rats. Fig 1, Table 1 Shows A single oral administration with all the three extracts from *Acacia arabica bark*

**Table 3: Effect of AACWE on blood glucose level of alloxan induced diabetic rats (chronic effect)**

Group No	Treatments	Dose mg/kg p.o	1 <sup>ST</sup> Day	3 <sup>rd</sup> Day	5 <sup>th</sup> Day	7 <sup>th</sup> Day
I	<b>Normal control</b>	5 ml	84.00±2.14	85.10±2.50	84.15±1.54	85.21±1.34
II	<b>Diabetic control</b>	10	215.20±4.18	230.16±3.48	235±28±2.56	237.14±2.24
III	<b>AACWE.</b>	400	225.75±1.59	179.23±1.82**	134.53±1.39**	87±1.56**

Values are given in average body weight (g) ±SEM for groups of five animals each. Vehicle (Tween 80) Diabetic control 150mg/kg b. w. dose. (Alloxan)

\**P* < 0.05 as compared to vehicle control. \*\**P* < 0.01 as compared to normal

demonstrated the efficacy of Alloxan through the glibenclamide studies in diabetic rats as well as in normal hyperglycemic rats. In the present study, the hypoglycemic activity of cold water extract, hot water extract and hydro alcoholic extract

caused a significant decrease in serum glucose levels in normal rats with dose 400mg/kg b.w for AACWE and AAHWE whereas in AAHAE dose is 196 mg/kg b.w. Moreover, these doses of the extract from *Acacia arabica bark* produced the

**Table 4: Effect of AACWE on blood cholesterol, creatinine and triglycerides level of alloxan induced diabetic rats after 7<sup>th</sup> day.**

Group No	Treatments	Dose mg/kg p.o	Cholesterol#	Creatinine#
I	<b>Normal control</b>	5 ml	154.20±1.46	0.54±0.02
II	<b>Diabetic control</b>	10	266.14±1.68	1.53±.04
III	<b>AACWE.</b>	400	180.40±6.53**	0.62±0.36**

Values are given in average body weight (g) ±SEM for groups of five animals each. Vehicle (Tween 80) Diabetic control 150mg/kg b. w. dose. (Alloxan)

\**P* < 0.05 as compared to vehicle control. \*\**P* < 0.01 as compared to normal

maximum glucose lowering in diabetic rats serum. Fig 2, Table 2 shows a significant time-dependent hypoglycemic effect was shown throughout the period studied. Based on the hypoglycemic effect in normal and diabetic rats, these results reinforce the hypothesis that the hypoglycemic mechanism involves an insulin-like effect, probably, through peripheral glucose consumption [20-22]. Although the cold water extract from *Acacia arabica* bark displayed a higher significant hypoglycemic effect in normal rats in acute as well as chronic case Fig 3, Table 3 the main mechanism by which *Acacia arabica* brings about its hypoglycemic action probably is by stimulating peripheral glucose consumption since the extract did not have an effect on the glucose tolerance curve. Additionally, the glycemia profile observed to glibenclamide group points that the cold water extracts from *Acacia arabica* bark acts in liver or in peripheral glucose consumption. In this context a number of other plants have also been reported to have hypoglycemic effects [23, 24]. From the studies with the tested plant extract, the optimal hypoglycemic activity was demonstrated at a dose of 400 mg/kg. Consequently, this dosage was considered as a quantitative basis to study in severe alloxan-diabetic rats or in normal animals. More ever Table 4 shows that the *Acacia arabica* cold water extract significantly lower the blood cholesterol, creatinine and triglycerides level of alloxan induced diabetic rats after 7<sup>th</sup> day.

## Conclusion

In the light of the results, our study indicates that *Acacia arabica* Bark extracts have good antidiabetic activity. Methanolic and aqueous extracts of *Acacia arabica* exhibited significant antihyperglycemic activities in Alloxan induced hyperglycemic rats. Out of all the extracts cold aqueous extract of *Acacia arabica* shows higher significant antihyperglycemic activity. This Extract also shows improvement in parameter like Blood cholesterol and creatinine and so might be of value in Diabetes treatment.

## List of Abbreviation

AAHAE:-*Acacia Arabica* hydro alcoholic extract.

AAHWE: - *Acacia Arabica* hot water extract.

AACWE: - *Acacia Arabica* cold water extract.

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