EFFECTS OF ACACIA ARABICA AND CARALLUMA EDULIS ON BLOODGLUCOSE LEVELS OF NORMAL AND ALLOXAN DIABETIC RABBITS

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Abdul Wadood, Noreen Wadood, S. A. Wahid Shah (Department of Pharmacology and Therapeutics, khyber Medical College, Peshawar.)

Abstract

The powdered seeds of Acacla arabica and roots of Caralluma edulis were administered in doses of 2, 3 and 4 gm/kg body-weight to normal and alloxan-diabetic rabbits. The blood glucose levels were estimated before and 2, 4, 6 and 8 hours after the administration of plant suspension. The powdered seeds of Acacla Arabica exerted a significant ($P < 0.05$) hypoglycemic effect in normal rabbits. The hypoglycemic effect was not significant ($P > 0.01$) in alloxan diabetic rabbits. The powdered roots of Caralluma edulls did not produce any significant ($P > 0.01$) hypoglycaemic effect in normal as well as in alloxan diabetic rabbits. The doses used did not show any acute toxicity and behavioural changes. From this study it may be concluded that the powdered seeds of Acacia arabica act by initiating the release of insulin from pancreatic beta cells of normal rabbits. Moreover, Caralluma normal as well as in diabetic rabbits (JPMA 39:208,1989).

INTRODUCTION

Many indigenous remedies have been traditionally used in the treatment of a variety of diseases including diabetes mellitus[1]. Several such plants show hypoglycaemic activity when taken orally, for example Coriandrum sativum, Dacucus carota, Brassica oleracea, Cassia occidentails, Olea europea and Zingiber officenale[2]. Said[3], Farsworth and Scgelman[4] and Ikram[5] have reported the anti-diabetic activity of a number of herbs and plants, amongst these, Acacia arabica and Caralluma edulis, locally known as "Kikar" and “Chung” respectively, have been used by practitioners of Asian system of medicine for the treatment of diabetes mellitus[6]. Acacia arabica belongs to the family Leguminosae. This tree, found all over the subcontinent[9] yields an abundant supply of gum. The decoction of its bark is used in diarrhoea, dysentery and gargles for spongy gums. The bark is astringent and is used as a tan[10]. The powdered seeds have been found useful in the treatment of diabetes mel- litus[6,8]. Caralluma edulis belongs to the familyAsclepiadeae. Its bitter stem and roots are used as vegetables. Its roots are used in the treatment of diabetes mellitus[10]. The present work has been undertaken with the aim to study the effect of powdered seeds of Acacia arabica and powdered roots Caralluina edulis on the blood glucose levels of normal and alloxan diabetic rabbits. Acute toxicity and behavioural changes were also studied to check the safety of these doses.

MATERIAL AND METHODS

Experiments were performed on male, adult rabbits of local strain weighing 0.65-1.82 kg. They were fed on green vegetables and grains and allowed tap-water ad libitum.

Chemicals

Alloxan monohydrate was supplied by B.D.H. Laboratories (Chemical Division), Poole, England. Otolodine, Glacial acetic acid, Thiourea and Thchloroacetic acid were obtained from E. Merck,

Dermstadt, West Germany. Tolbutaniide was provided by Hoechst, West Germany.

Plant Material

The seeds of Acacia arabica were obtained from local trees of University Campus. The fresh roots of Caralluma edulis were purchased from local vegetable market of Peshawar. They were carefullywashed with water to remove dust and any otherforeign material and dried under the shade. The completely dried seeds of Acacia Arabica and roots of Caralluma edulis were powdered with an electric grinder and stored in cellophane bags at 4°C in the refrigerator.

Preparation of Diabetic Rabbits

Using Akhtar et al11 method a group of rabbits were made diabetic by injecting intravenously, 150mg/kg body weight of alloxan monohydrate. Eight days after injection, the blood glucose levels of surviving rabbits were estimated. Rabbits with blood glucose levels above 200mg/lOOm! were considered as diabetic.

Grouping of Rabbits

Normal rabbits were divided into 5 groups of six animals each. Group 1 served as control and received 15m1 of 2% gum tragacanth solution. Group 2 received tolbutamide 500mg/kg body weight. Group 3-5 received dried powdered seeds of Acacia arabica dissolved in 15ml of 2mg/kg, 3gm/kg and 4gm/kg respectively. The diabetic rabbits were also divided in 5 groups on the same pat tern. Similar to above, S groups of six rabbits each were made to study the effects of powdered roots of Caralluma edulis. Group 1 served as control received 15ml of 2% gum tragacanth solution. Group 2 received tolbutamide 500mg/kg body weight. Group 3-5 received dried powdered roots of Caralluma edulis dissolved in 15ml of 2% gum tragacanth solution in doses of 2gm/kg, 3gm/kg and 4gm/kg respectively. The diabetic rabbits were also divided inS groups on the same pattern.

Preparation and Administration of Plant Suspension

The amount of powdered seeds of Acacia arabica and powdered roots of Caralluina edulis required for each rabbit was calculated on body weight basis and it was dissolved in lOmlof 2% gum tragacanth solution and fmal volume made upto 15ml. The suspension was administered to each rabbit by using a stomach tube attached to a standard syringe containing the 15ml of the suspension. The tube was inserted into the stomach through oesophagus and the plunger was pressed slowly and steadily. Immediate sneezing and coughing indicated injection into the lungs and in such a condition tube was at once withdrawn and another animal was takeninstead. The tolbutainide solution was administered in a similar manner.

Collection of Blood

The procedure for collection of blood was adopted as described byAkhtar and Ali[12]. The rabbit was held in a wooden rabbit holder and immediately before administration of drug, 0.2ml of blood for glucose estimation was collected from an ear vein. Similar blood samples were collected at 2,4,6 and 8 hours after the administration of drug. After collection of blood the pricked site of the ear was rubbed with cotton wool soaked with 70% alcohol to protect the rabbit against infections.

Blood Glucose Estimation

Blood glucose estimation was done by the method of Winckers and Jacobs[13].

Acute Toxicity Studies

The possible toxic effects of the powdered seeds of Acacia arabica and powdered roots of Caralluma edulis were studied on rabbits of local strain weighing 0.50-1.71kg. The rabbits were divided into 4 groups (1-4) of six animals each. Group 1 served as control and received 15ml of 2% gum tragacanth solution. Group 2-4 received powdered seeds of Acacia arabica dissolved in 15ml of 2% gum tragacanth solution in doses of 2gm/kg, 3gm/kg and 4gm/kg respectively. Animals were observed for 8 hours after the administration of plant suspension to check toxic symptoms. They were kept under observation for 7 days. Similar to above, 4 groups of six animals were made to study the possible toxic effects of Caralluma edulis.

RESULTS

The effects of different doses of Acacia arabica, Caralluma edulis, tolbutamide and gum tragacanth on blood glucose levels of normal and alloxan-diabetic rabbits are shown in Table I,II and figure I,II.

TABLE I. Effect of Acacia arabica, Caralluma edulis and Tolbuta mide on Blood Glucose level of normal Rabbitis.

Time interval (Hours)	Blood Glucose in mg/kg							
	Control	Tolbutamide	Acacia arabica			Caralluma edulis		
		(500mg/kg)	2gm/kg	3gm/kg	4gm/kg	2gm/kg	3gm/kg	4gm/kg
0	98.70±2.79 (6)	101.8±1.41 (6)	105.0±2.86 (6)	109.0±2.51 (6)	108.6±2.49 (6)	104.1±2.3 (6)	101.7±2.1 (6)	100.0±2.4 (6)
2	97.50±2.91 (6)	87.35±1.3 (6)	94.5±2.64 (6)	91.0±2.20 (6)	78.0±1.5 (6	103.5±2.6 (6)	101.2±2.0 (6)	99.8±3.2 (6)
4	97.0±3.41 (6)	73.0±0.91 (6)	91.0±1.93 (6)	84.0±2.35 (6)	71.2±1.93 (6)	103.7±2.0 (6)	100.8±2.6 (6)	99.6±2.1 (6)
6	97.2±2.81 (6)	76.9±0.82 (6)	89.2±1.63 (6)	80.5±2.31 (6)	64.4±2.1 (6)	103.9±2.4 (6)	100.5±2.3 (6)	99.1±2.1 (6)
8	98.41±3.23 (6)	77.84±0.75 (6)	92.8±4.2 (6)	82.6±2.32 (6)	66.4±3.5 (6)	103.8±3.1 (6)	101.0±2.4 (6)	99.5±2.6 (6)

Figure in parenthesis indicate number of animals.
Each value represents the meand±standard error.

TABLE II. Effect of Acacia arabica, Caralluma edulis and Tolbutamide on Blood Glucose levels of Alloxan-diabetic Rabbits.

Time interval (hours)	Blood Glucose in mg/dl							
	Control	Tolbutamide	Acacia arabica			Caralluma edulis		
		(500mg/kg)	2gm/kg	3gm/kg	4gm/kg	2gm/kg	3gm/kg	4gm/kg
0	452.3±4.2 (6)	440.2±2.7 (6)	445.5±3.2 (6)	470.0±4.7 (6)	435.2±3.8 (6)	385.7±3.5 (6)	380.0±4.0 (6)	394.6±5.2 (6)
2	450.0±4.0 (6)	439.0±3.7 (6)	443.3±4.1 (6)	465.6±3.7 (6)	433.2±4.1 (6)	380.6±4.1 (6)	377.4±5.2 (6)	393.5±4.7 (6)
4	447.6±5.1 (6)	438.3±2.8 (6)	440.1±3.8 (6)	463.7±4.2 (6)	430.1±5.1 (6)	378.1±4.6 (6)	375.7±4.7 (6)	392.6±4.6 (6)
6	447.0±4.3 (6)	438.0±3.6 (6)	438.3±4.5 (6)	462.9±3.5 (6)	428.4±4.2 (6)	376.7±5.2 (6)	373.8±5.1 (6)	391.8±4.9 (6)
8	448.6±3.8 (6)	437.5±4.3 (6)	438.7±3.6 (6)	464.8±4.0 (6)	429.9±3.9 (6)	378.9±4.4 (6)	376.4±5.1 (6)	393.0±4.0 (6)

Figures in parenthesis indicate number of animals.
Each value represents the mean±standard error.

Figure 1. Effect of Acacia arabica, Caralluma edulis and tolbutamide on blood glucose levels of normal rabbits.

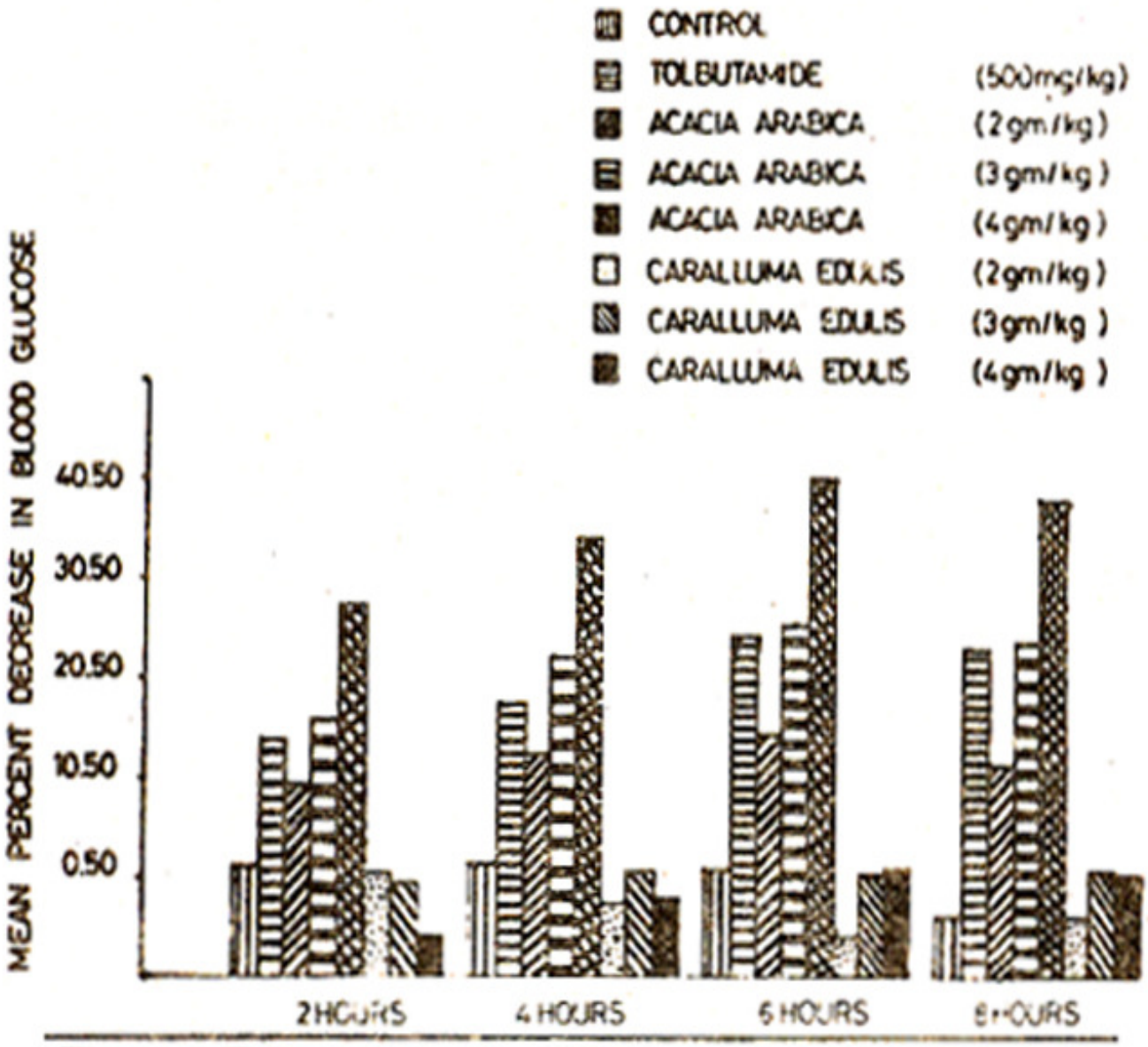

Figure 1. Effect of Acacia arabica, caralluma edulis and tolbutamide on blood glucose levels of normal rabbits.

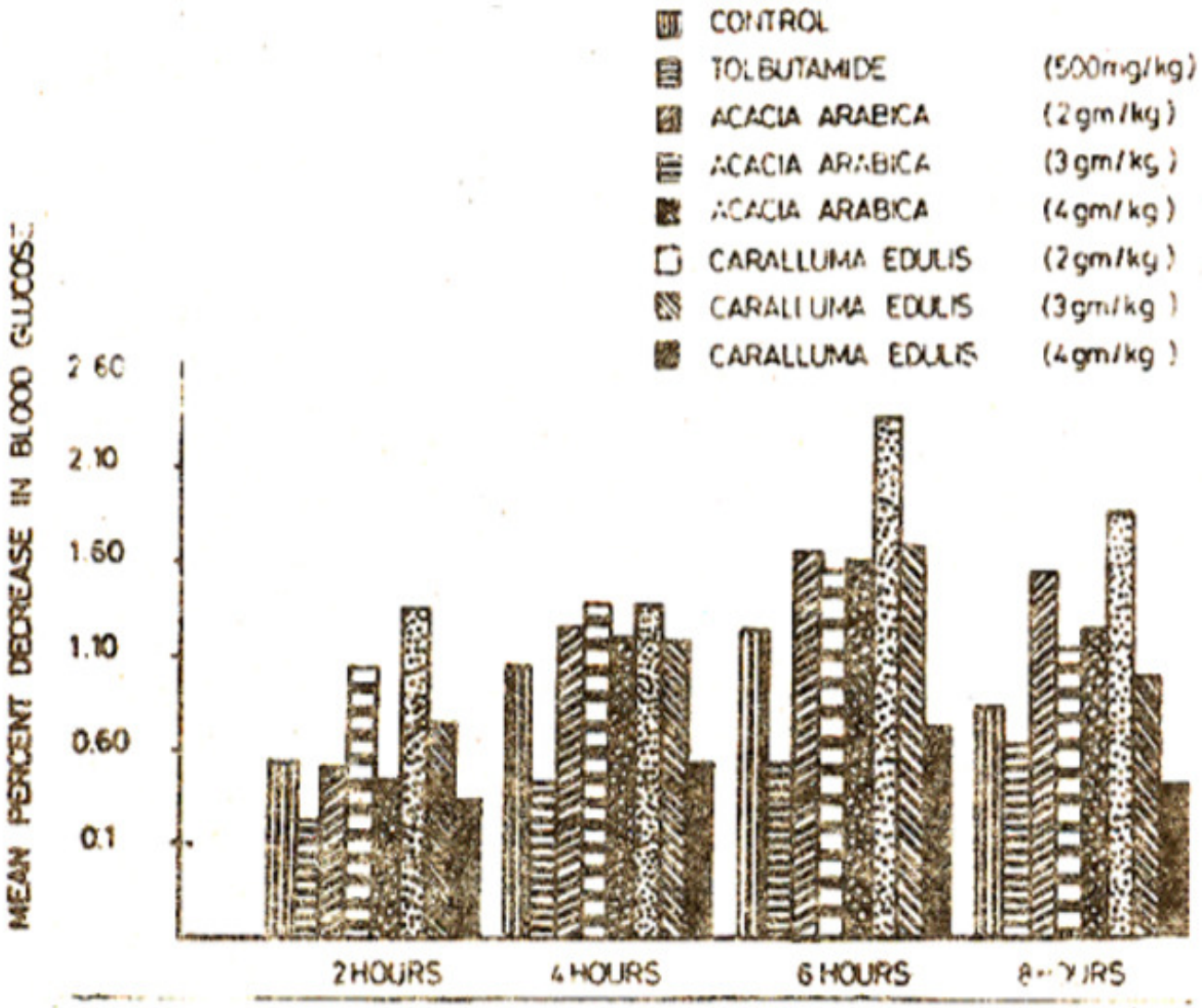

Figure 2. Effect of Acacia arabica, Caralluma edulis and tolbutamide on blood glucose levels of alloxan diabetic rabbits.

The mean percent decrease in blood glucose levels produced by 2gm/kg of Acacia arabica at 2,4,6 and 8 hours were 10.0±0.58, 13.3±0.35, 15.0±0.76 and 11.6±0.97 respectively while those produced by 3gm/kg of Acacia arabica at similar interval were 16.51±0.68, 22.93±0.97, 26.14±1.08 and 24.22±23 respectively and that produced by 4gm/kg of Acacia arabica at 2,4,6 and 8 hours were 28.1±0.71, 34.4±0.56, 40.6±1.65 and 38.85±1.1 respectively. All the three doses showed significant reduction (P <0.05) in blood glucose levels. The mean percent decrease in blood glucose levelsproducedby2gm/kgofCaralluma edulis at2, 4, 6 and 8 hours were 0.57±0.05, 0.38±0.06, 0.19±0.01 and 0.28±0.03 respectively while that produced by 3 gm/kg of Caralluma edulis at similar intervals were 0.49±0.1,0.90±0.08,1,17±0.05 and 0.68±0.09 respectively and that produced by 4gm/kg of Carallunia edulis at 2, 4, 6 and 8 hours were 020 ± 0.07,0.40± 0.02,0.90± 0.05 and 0.50 ± 0.04 respectively. All the doses showed no significant change in the reduction of blood glucose levels. The mean percent decrease in blood glucose levels produced by 500mg/kg of tolbutamide at 2,4,6 and 8 hours were 14.19±0.75, 28.29±1.2, 24.45±1.7 and 2353±0.92 respectively, (significant P <0.05) while that produced by 15ml of 2% gum tragacanth solution at 2,4,6 and 8 hours were 121 ± 0.11, 1.72 ± 0.13, 1.51 ± 0.10 and 0.29 ± 0.05 respectively (not-significant P >0.10). With Acacia arabica the mean percent decrease in blood glucose levels at 2, 4, 6 and 8 hourswere 0.49 ± 0.07,121± 0.03,1.61±0.08

and 1.52 ± 0.09 respectively, with 2gm/kg dose and 0.93±0.04,1.34±0.07,1.51 ± 0.06 and 1.10 ±0.09 respectively, with 3gm/kg and 0.45 ± 0.06, 1.17 ± 0.03, 1.56 ± 0.02 and 1.21 ± 0.06 respectively with 4gm/kg dose. All the results showed no significant. reduction in blood glucose levels. With Caralluma edulis the mean percent decrease in blood glucose levels at 2,4,6 and 8 hours were 1.32 ± 0.06, 1.37 ± 0.09,2.33 ± 0.85 and 1.76 ± 0.76 respectively with 2gm/kg dose and 0.68 ± 0.05, 1.13 ± 0.07, 1.63 ± 0.05 and 0.94 ± 0.08 respectively with 3gm/kg and 027 ± 0.03, 0.50 ± 0.05,0.70 ± 0.07 and 0.40 ± 0.01 respectively with 4gm/kg dose. All the results were not significant. The mean percent decrease in blood glucose levels produced by 500mg/kg of tolbutamide at 2,4, 6 and 8 hours were 022 ± 0,03,0.43 ± 0.01, 0.49 ± 0.87 and 0.61 ± 0.13 respectively (not-significant) while that with 15ml of 2% gum tragacanth solution similar interval wereO.50 ± 0.07,1,03 ± 0.05,1.17 ± 0.91 and 0.81 ± 0.06 respectively, (not-significant). Acute Toxicity Study The rabbits receiving 2gm/kg, 3gm/kg and 4gm/kg of powdered suspension of Acacia arabica and Caralluma edulis did not show any visible signs of toxicity e.g. excitement, restlessness, respiratory distress, convulsions or coma. Moreover, they re mained alive for upto 7 days.

DISCUSSION

The present study showed that the gum tragacanth solution used as vehicle did not produce any significant (P >0.01) change on blood glucose levels of normal and on alloxan induced diabetic rabbits. This finding is in accordance with the observations of Marquis et al[14] and Akhtar et al[15]. It was also observed that powdered seeds of Acacia arabica produced a significant hypoglycaemic effect when administered orally to nor-mal rabbits. While its seeds in dose of 4gm/kg produced a maximum decrease in blood glucose levels of normal rabbits. The observations also indicate that hypoglycaeniic effect in normal rabbits develops slowly and is most pronounced about 6 hours after the administration. The seeds of Acacia arabica, however, did not show any significant effect on blood glucose levels of alloxan-treated rabbits. For comparison the effect of the standard hypoglycaemic drug tolbutamide (500mg/kg) was observed on the blood glucose levels of normal and alloxan treated diabetic rabbits. Tolbutamide produced significant hypoglycaemic effect in normal rabbits but not in alloxan-treated rabbits. This finding is in accordance with the observation of Augusti and Benaim[16] and Akhtar et al[17]. Sulphonylureas including tolbutamide have been reported to produce hypoglycaemia by stimulating pancreatic fi cells to release more insulin into the blood stream, thus increasing glycogen desposition in the liver, causing a reduction of glycogen levels, and having an extra pancreatic effect to possibly increase the number of insulin receptors[18]. In view of the similarity between the effect of toibutamide and Acacia arabica, it may be likely that the hypoglycaemic effect of Acacia arabica also be mediated through the release of insulin from the pancreatic beta cells. A similar mechanism has been proposed to explain the hypoglycaemic effect in normal rabbits of other indigenous plants such as Thcoma Stans[19], Momordica Foetida[14] Euphorbia prostrata and Fumaria Parviflora[15]. Eriobotria Japonica[20] and Gymnema Sylvestre[21,22].The observations show that the roots of Caralluma edulis did not produce any significant hypoglycaemic effect in normal or in alloxan treated diabetic rabbits. This indicates that Caral luma edulis is devoid of antidiabetic activity but is traditionally used only on empirical grounds in the folk medicine.

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