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Experimental Evaluation of Hypoglycaemic Activity of A Compound Herbal Plant Formulation Against Acute Hyperglycaemic Condition

Ayurveda

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Dwivedi, K.n. Professor, Department Of Dravyaguna, I.m.s., B.h.u. & Consultant Diabetic Clinic (Ayurveda), S. S. Hospital, B. H. U., Varanasi-5; Resident, Department Of Dravyaguna, I.m.s., B.h.u., Varanasi.

Misra S. Scientist, Varuna Herbo Biotec Pvt Ltd, R & D Unit, B 1/84-P, Ravindrapuri Extension, Varanasi – 221005

ABSTRACT

Though Ayurvedic medicinal plants are being internally administered since thousand of years, it is a scientific approach to investigate them through experimental models in order to evaluate their efficacy more accurately as well as to detect any possible toxicity. Present study is aimed to evaluate the hypoglycaemic effect of an Ayurvedic compound drug formulation consisting of medicinal plants / parts of the plants by virtue of their actions and properties are being used traditionally since ancient era for the treatment of Madhumeha (Diabetes mellitus), Viz – Heartwood of Vijaysar (Pterocarpus marsupium)(1,2,3) Fruits of Karela (Momordica charantia)(4), Seeds of Jambu (Eugenia jambolana)(5), Leaves of Tejpatra (Cinnamomum tamala)(6), Seeds of Methica (Trigonella foenum graceum)(7), Rhizomes of Kutaki (Picrorrhiza kurroa)(8), Leaves of Nimba (Melia azadirachta)(9), Leaves of Gudmar (Gymnema sylvestre)(10) and leaves of Tulsi (Ocimum sanctum).

It would be of interest to investigate the effect of the aforesaid medicinal plants in a combined form against the Alloxan induced, Hydrocortisone induced hyperglycaemic responses in albino rats. We thought to combine these drugs in the form of a single formulation and evaluate its efficacy against P. marsupium (standard drug) whose anti-diabetic property is mentioned by many authors. (1)

Introduction

Diabetes Mellitus is defined as the state of chronic hyperglycemia due to impairement of insulin secretion or its action. Diabetes Melitus (DM) comprises a group of common metabolic disorders that share the phenotype of hyperglycemia.

India, home to over 61 million diabetics, is now putting together plans for massive global scientific projects to find innovative ways to fight the disease, whose burden has gone up in the country by 50.8 million since 2010. The International Diabetes Federation says by 2030, India's diabetes burden is expected to cross the 100 million mark as against 87 million earlier envisaged. The country is also the largest contributor to regional mortality with 9.83 lakh deaths attributed to diabetes last year. Latest statistics revealed by the International Diabetes Federation's 5th Diabetes Atlas say, India's prevalence of diabetes among 20-79-year olds is 9.2%. In sheer numbers, India, however, is only second to China. In 2011, China had 90 million diabetics that will increase to about 130 million by 2030. (11)

In the present study aqueous extract of all above mentioned drugs were standardized separately in a scientific manner to form a 550 mg test drug formulation (under the brand name –Episulin) consisting of Pterocarpus marsupium heart wood (aq. Extract), Momordica charantia fruit, Cinnamomum tamala leaves, Trigonella foenum graecum seeds, Eugenia jambolana seeds, Melia azadirachta leaves, Picrorrhiza kurroa rhizome, Gymnema sylvestre leaves and Ocimum sanctum leaves.

For comparison of the effect of the test drug, water soluble solid extract of Vijaysar (Pterocarpus marsupium) which is already claimed as anti-hyperglycaemic agent, was used as standard drug.

Aims and objective

Experimental Evaluation of Hypoglycaemic activity of a compound medicinal plant formulation against the acute Hyperglycaemic responses.

Methodology

For each experiment equal number of rats were selected & divided in three separate groups Viz. A, B & C. Rats of group A were treated by test drug (Episulin), rats of group B were treated by standard drug ie; Vijaysar extract alone and rats of group C were kept as control group and plain distilled water was given to them in order to compare the blood sugar level of this group with that of A & B. The test drug, standard drug and water was administered orally to rats by means of gastric tube.

A- Effect of Test Drug on Blood Sugar Level in Normoglycaemic Rats

Thirty rats of either sex, weighing 100-120 gms were selected for the experiment. They were divided into three groups – A, B & C having 10 rats in each group. Initial blood samples of every rat was collected in fluoride oxalate bottle from their inner canthus of eyes through capillary tube.

5% aqueous solution of test drug was prepared and given orally through gastric tube to the rats of group 'A' in a dose of 30 mg/100 gm body weight per day for 7 days. (This optimum dose was selected after plotting dose response curve for 3 different doses.)

5% aqueous solution of water soluble solid extract of Vijaysar was prepared and given orally to the rats of group 'B' in a similar dose of 30 mg/100 gm body weight per day for 7 days. Rats of group 'C' were kept as control group and distilled water 1 ml / 100 gm body weight was given to them daily for seven days. During this period all animals received normal laboratory diet. Blood samples from all rats were collected on 1st, 3rd, 5th and 7th day of above drug treatment.

B- Effect of Test Drug on Blood Sugar Level in Alloxan induced hyperglycaemic Rats

Thirty rats of either sex weighing 100-120 gms were selected for this study. They were kept fasting for 24 hrs prior to the experiment however, water was allowed during this period. Initial blood samples of every rat was collected as mentioned earlier. Freshly prepared 5% aqueous solution of Alloxan monohydrate was injected intra-peritonially to all the rats in a dose of 150 mg / kg body weight. At the end of six hrs 5% glucose solution was given orally to all the rats in a dose of 5 gm / kg body weight to prevent Alloxan induced phase of hypoglycaemia. Next day, at the end of 24 hrs of Alloxan administration blood samples were collected from all the rats and then rats were divided into three groups A, B & C having ten rats in each group. 5% aqueous solution of test drug was administered to the rats of group A orally in a dose of 30 mg / 100 gm body weight daily for seven days as earlier. 5% aqueous solution of water soluble solid extract of Vijaysar was prepared and given orally to the rats of group 'B' in a similar dose of 30 mg/100 gm body weight per day for 7 days.

Rats of group 'C' were kept as control group and distilled water 1 ml / 100 gm body weight was given to them daily for seven days. During this period all animals received normal laboratory diet. Blood samples from all rats were collected on 1st, 3rd, 5th and 7th day of above drug treatment.

C- Effect of Test Drug on Blood Sugar Level in Hydrocortisone induced hyperglycaemic Rats

Thirty rats of either sex, weighing 100-120 gms were selected for the experiment. They were divided into three groups – A, B & C having 10 rats in each group. Initial blood samples of every rat was collected in fluoride oxalate bottle as mentioned earlier. Hydrocortisone in a dose of 50 mg / kg body weight was injected intraperitonially to every rat for seven days. On either day blood samples were collected. The rats were now divided into three groups A, B & C each consisting of ten rats. Test drug in the form of 5% aqueous solution was given orally to the rats of group A in a dose of 30 mg / 100 gm body weight daily for seven days.

To the rats of group 'B' 5% aqueous solution of water soluble solid extract of Vijaysar was given orally in a similar dose of 30 mg/100 gm body weight per day for 7 days.

Rats of group 'C' were kept as control group and distilled water 1 ml / 100 gm body weight was given orally to them daily for seven days.

Their blood samples were collected on 1st, 3rd, 5th and 7th day of respective drug treatment. During this period all animals received normal laboratory diet.

Result and Observations

Table – 1 : Effect of drugs on mean blood sugar levels (mg%) in normoglycaemic rats (n=10 in each group)

Days	Group A (n)	Group B (n)	Group C (n)
Before drug treatment (1st day)	130.03	112.01	120.47
On 3rd day of drug treatment	125.86	112.98	115.22
On 5th day of drug treatment	125.47	117.93	125.06
On 7th day of drug treatment	126.09	117.39	116.06

Table – 2 : Effect of drugs on mean blood sugar levels (mg%) in alloxan induced hyperglycaemic rats (n=10 in each group)

Days	Group A (n)	Group B (n)	Group C (n)
Before Alloxan	105.46	107.96	105.35
24 hrs after Alloxan (1st day of drug treatment – prior to drug administration)	373.73	397.06	388.07
On 3rd day of drug treatment	350.13	383.11	414.00
On 5th day of drug treatment	276.21	324.18	420.20
On 7th day of drug treatment	204.46	280.83	441.59

Table – 3 : Effect of drugs on mean blood sugar levels (mg%) in hydrocortisone induced hyperglycaemic rats (n=10 in each group)

Days	Group A (n)	Group B (n)	Group C (n)
Before Hydrocortisone	106.61	106.95	113.89
After 7 days of Hydrocortisone administration(1stdayof drug treatment– prior to drug administration)	136.35	144.62	128.50
On 3rd day of drug treatment	130.14	139.48	140.34
On 5th day of drug treatment	126.29	137.08	148.46
On 7th day of drug treatment	122.68	130.88	311.74

Discussion

In the present investigation, inhibitory effect of oral anti-diabetic test drug was observed against the acute hyperglycaemia induced by the alloxan and hydrocortisone and is compared with standard Pterocarpus marsupium extract.

As is evident from Table – 1 that neither the test drug nor Vijayar extract is capable of producing hypoglycaemia in normoglycaemic rats. We therefore may infer that both the drugs are free from producing hypoglycaemic danger if given to humans.

The blood sugar level in alloxan induced group increased gradually up to the 7th day of induction in the untreated animals. The animals of the Group A and Group B (Table – 2) have shown significant hypoglycaemic response. Analysis of the data presented in Table – 2 shows that the test drug under study as well as the standard drug (Vijaysar) have a favourable influence to retard hyperglycaemic process induced by Alloxan. This inhibitory effect is more marked in animals treated with the test drug than that of the standard drug i.e; Vijaysar alone. This might be due to the synergistic action of the rest ingredients of test drug to the Vijaysar extract present in the formulation.

The hyperglycaemic effect of the hydrocortisone extract is well marked and quite significant after 7 days of hydrocortisone induction in untreated animals. An appreciable inhibition of the hyperglycaemic response of the hydrocortisone extract was observed in animals treated with the oral antidiabetic test drug and standard drug, as would be apparent on comparing the blood sugar levels of the control and treated animals in Table – 3. The inhibitory effect was more marked in animals of Group A as compared to Group B, thus again confirming the synergistic action of the test drug formulation to that of the P. marsupium.

Experimental studies on action of Vijaysar by various workers have demonstrated the hypoglycaemic action in animals. Clinical studies undertaken on Vijaysar heartwood(12,13) Vijaysar bark(14) have shown encouraging anti-diabetic action. Vijaysar extract was reported to reverse the diabetogenic action in alloxan induced diabetic rats(15). Concurrent histological studies of the pancreas in these animals showed regeneration of the b cells population of the Islets which was earlier necrosed by alloxan. Immuno reactive insulin studies also confirmed that the regenerated b cells of the pancreas were functional in nature(16). Our findings also confirm these reports of the Vijaysar, along with its synergistic action in controlling the blood sugar level with other indigenous – oral antidiabetic drugs of plant origin.

The underlying cellular and molecular mechanism of these observed beneficial effects of the test drug Episulin are to be investigated.

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