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Comparative efficacy of two medicinal plants and Amaryl® tablet (Glimepiride) in induced diabetes mellitus in rat

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Abstract

Comparative efficacy of two indigenous herbal extracts, (*Trigonella foenum-graecum* seed & *Coccinia indica* leaves) with the commonly used drug Glimepiride were studied. Healthy young rats (n=30) of both sexes weighting between 150 to 200 gm were selected and divided into six equal groups, as A (Control), B (diabetic), experimental diabetic groups were- C, D, E and F, treated with combined extract of Methi seed and Telakucha leaves- @ 250mg, 500mg, 750mg and Glimepiride 800µg/kg body weight, respectively. The substances were given orally once daily for14 days. The blood glucose concentration were decreased significantly ($P<0.01$) in groups C, D, E, and F. The body weight increased significantly ($P<0.05$) by 2.3%, 3.9%, 4.8% and 10.4%, respectively. The herbal extracts significantly reduced in blood glucose level with the increased in body weight. It is indicated that antidiabetic activity of *Trigonella foenum-graecum and Coccinia indica* are evident that are traditionally used as the herbal preparations by the Ayurvedic practitioners for the control of diabetes mellitus.

Keywords: *Trigonella foenum graecum*, *Coccinia indica,* Amaryl® Tablet (Glimepiride), Streptozotocin and antidiabetic effect, Diabetes mellitus, Rat

Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by impaired metabolism of glucose, which is associated with insulin deficiency and results hyperglycemia, often accompanied by glucosuria and polyuria. Correspondingly, there is considerable hunger and thirst and weight loss and in severe cases, ketonuria, ketonemia and acidosis occurs. It is an incurable disease but, normal life can be led through controlled diet and with the use of specific anti-diabetic drug and discipline. On the other hand, modern oral hypoglycemic agents (glimepiride) is costly which showed some adverse effects, expensive and also develop resistance to diabetes, so that it was attempted to develop an alternative source of drug for controlling diabetes mellitus. Plant sources of hypoglycemic agents are easily available, cost-effective and presumably devoid of any side effects. Among the indigenous plants that are noteworthy for their hypoglycemic and antihyperglycemic principles include Methi, neem, telakucha, karella, nayantara.(Reff.). Methi seeds having antidiabetic properties. *Coccinia indica* (Cucurbitaceae), (Khan e*t.al*., 1979) is another important herb, locally known as Telakucha. There is evidence of hypoglycemic effect of Neem(*Azdirachta indica*), Nayantara (*Catharanthus roseus*), Garlic (*Alliumsativum*), Karela (*Momordica charantia*)and Methi(*Trigonella foenum graecum*), (Mostofa *et al.*, 2007) The crude extract of the green leaves from above plant telakucha posses hypoglycaemic activity both in human diabetics and in diabetic induced animals (Khan *et. al.,*1979; Mukherjee *et. al.,*1988).No precise reports on the herbal extracts on diabetic are available. The study why undertaken to compare the antidiabetic activity of *Trigonella foleum –graceum* seed and *Coccinia indica,* Amaryl® (glimepiride) and a synthetic product.

Materials and Methods

Dried seed of Methi were taken from local market and fresh leaves of Telakucha were collected from the University Botanical Garden, Mymensingh. Leaves extract were prepared, tablets Amaryl® (Glimepiride) was purchased from local cooperative Market and dissolved in distilled water (1mg/mlwater). Ten Long Evan's strain (*Ratus norvegicus*), aged 5 weeks and weighing between 100 to 150 gm were collected from International Center for Diarrheal Disease Research, Bangladesh (ICDDRB). The rats were reared 30 days and then the males and females were kept together at the ratio of 1:4 for reproductive purpose. After 3 weeks the female gave birth and then the offspring were reared for 2 months. In this experiment 30 healthy rats of both sexes weighting between 150 to 200 gm were selected from these offspring. These rats were divided into six equal groups, (5 rats in each group) namely Group-A normal control, Group- B-diabetic control and Group C, D, E, and F were kept for experimental purposes. The rats were maintained in wire cages in the experimental animal house for 30 days. The rats were fed normal diet and water ad libitum. After acclimatization, body weights and blood glucose level were measured after 18 hours of starvation. Streptozotocin was dissolved in 0.1 M citrate buffer having pH 4.5. Then streptozotocin injection was given to rat @ 55 mg/kg body weight intraperitoneal route to each rat of Group-C, D, E, and F to induce diabetes. Blood glucose level and body weight were measured after 15th day of streptozotocin injection. Methi & Telakucha @ 250mg/kg, 500mg/kg, 750mg/kg body weight for Groups C, D, and E and Amaryl® tablet(glimeperide) @ 800µg/kg body weight for Group F were given orally once daily. Blood glucose level and body weight were measured on Day 0, 7 and 14.

Results and Discussion

Blood glucose concentration on day 0, 7 and 14 were 5.5±0.2 to 5.5±0.4 mmol/L in normal control rats (Group A) and 30.5±0.8, to 31.6±0.5and 32.34±0.7 mmol/L the diabetic control rats (Group B). Following the treatment blood glucose concentration was significantly decreased by 9.95%, 21.4%, 32.3%and 49.4%, respectively and by 2.3%, 3.4%, 4.8%, and 10.4% respectively, for treatment Groups C, D, and E, and F (table 1) Amaryl® (glimepiride***)*** is a world wide recognized anti diabetic agent and are available commercially. The present study established that the the Methi (*Trigonella foleum –graceum***)** seed and Telakucha (*Coccinia indica)* leave extracts had potential hypoglycemic activity in rats compared with Amaryl® (glimepiride*)*. The combined action of Methi seeds and Telakucha leaves extract @750mg/kg resulted significant ($p<0.001$)hypoglycemic response. After 14 days of treatment with Glimepiride, the blood glucose levels were reduced significantly ($p<0.001$). This result is in conformity with that of Hossain (2006), Chowdhury *et. al., (2005*). Rats treated with *Trigonella foenum –graecum and Coccinia indica* had reduced ($p<0.01$) blood glucose level. Similar effect was reported by Ahmed *et. al.,* (2005) in rabbit. Choudhury *et. al.,* (2005) reported the reduction of glucose following administration of Methi seed extract. There are others several reports of similar nature (Devi *et. al.,* 2003, Vats *et. al.,* 2002; Pari and Saravan 2000, Raju *et. al.,* 2001, Vats *et. al.,* 1999; Ali *et. al.,* 1999).

The study resulted positive impact on after using Methi (*Trigonella foenum –graecum)* seed and Telakucha (*Coccinia indica)* leaves on body weight gain during experimental tenure. Following the treatment the body weight was increased by 2.4%, 3.4%, 4.8%, and 10.4% respectively for treatment Groups C, D, E. and F (Table 2).the combined action of Methi seed and telakucha leaves extracts @ 750 mg/ kg resulted significant ($p<0.01$) body weight gain. After 14 days of treatment with *Trigonella foenum –graecum* seed *and Coccinia indica* leaves extract and Amaryl® (glimepiride*),* the body weight gain were increased significantly ($p<0.01$) to the extent of 2 to 10.5 percent in compare to pretreatment period. In this study, the combined dosage of Methi seed and telakucha leaves extract @ 750 mg/kg body weight was effective (4.8%) in comparison with other dosages.

Table 1. Effects of combination of Methi seed & Telakucha leaves extract and Amaryl® (Glimepiride) tablet on Blood Glucose (m mol/L, mean±SE) in Normal and STZ treated diabetic Rat (n=5)

Groups	Drug, dose and route	Pre-treatment	Post-treatment		% increase in Blood Glucose over 14 days
		Day 0	Day 7	Day 14	
A	Normal control	5.5±0.2	5.5±0.4 NS	5.4±0.4 NS	0
B	Diabetic control	30.5±0.8	31.6±0.5[b] NS	32.4±0.7[b] NS	+ 6.2
C	Combination of Methi seed & Telakucha leaves extract @ 250 mg/kg, orally	30.7±0.27	29.0±0.3[a] *	28±0.4[a] **	- 9.0
D	Combination of Methi seed & Telakucha leaves extract @ 500 mg/kg, orally	31.7±0.5	28.1±0.3[a] **	24.9±0.3[a] ***	- 21.4
E	Combination of Methi seed & Telakucha leaves extract @ 750 mg/kg, orally	31.5±0.4	25.1±0.2[a] ***	20.9±0.3[a] ***	- 33.8
F	Amaryl® (Glimepiride) tablet@ 800 µg/kg, p.o.	31.3±0.1	22.0±0.4[a] ***	15.9±0.3[a] ***	- 49.4

Table 2. Effects of combination of Methi seed & Telakucha leaves extract and Amaryl® (Glimepiride) tablet on Body Weight gain (%) in Normal and STZ treated Diabetic Rat (n=5)

Groups	Drug, dose and route	0 day	7day	14day	% increase in b.wt. over 14 days
A	Normal control	186.3±22.4	187.01 ± 16.3 *	187.5±20.2 *	+ 0.6
B	Diabetic control	176.4±19.0	173.7±13.1 ***	171.9±11.1 ***	- 2.5
C	Combination of Methi seed & Telakucha leaves extract @ 250 mg/kg, orally	180.6±12.2	183.0±15.2[b] ***	184.6±19.3[b] ***	+ 2.3
D	Combination of Methi seed & Telakucha leaves extract @ 500 mg/kg, orally	178.4±17.4	182.5±14.1[b] ***	185.3±23.1[b] ***	+ 3.9
E	Combination of Methi seed & Telakucha leaves extract @ 750 mg/kg, orally	179.9±13.5	184.7±11.8[b] **	188.5±16.0[b] ***	+ 4.8
F	Amaryl® (Glimepiride) tablet 800 µg/kg, p.o.	172.6±18.6	178.1±12.9[b] ***	190.7±19.1[b] ***	+ 10.4

Values given above represent the Mean ± Standard Error (SE) of body weight of five animals.Values expressed in parentheses denotes maximum percentage of increase[b]/decrease[a.] SE=Standard Error,*** = Significant increase/decrease. (P=>0.000-0.001)=0.1%, **= Significant increase /decrease. (P=>0.001-0.01)=1%, *= Significant increase/decrease. (P=>0.01-0.05)=5%, NS = Non Significant increase/decrease.(P=>0.5-∞)

Result of the present study support partially the finding of Hossain *et. al.,* (2006),Baynes *et. al.,* (1993), Chowdhury *et. al.,* (2005). Devi *et. al.,* (2003);Vats *et.al.*,(2002); Pari and Saravan (2000), Bopana *et. al.,* (1997) and Ponnchanan *et. al.,* (1992).

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