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Anti-hyperglycemic Effect of *Aloe vera* Leave Extracts in Alloxan Induced Diabetic Rats

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Abstract

Diabetes mellitus is a metabolic disorder of multiple aetiology .The present study was conducted to investigate the anti-hyperglycemic effect of *Aloe vera* leaves. Diabetes was induced in albino rats by intraperitoneal injection of alloxan monohydrate (120mg/Kg). The anti-hyperglycemic effect of the aqueous (1.25g/Kg bw) and 80% ethanolic extracts (1.25g/Kg bw) of the plant were determined by oral administration of the extracts for a period of 28 days and fasting blood glucose level of each rat was determined before administering the drug on 0^{th}, 14^{th} and 28^{th} days. The anti-hyperglycemic effect of aqueous extract on 14^{th} and 28^{th} days were found to be 14.1%, 24.01% and ethanolic extracts on 14^{th} and 28^{th} days were 17%, 23.66% respectively with respect to diabetic water control group.

Keywords: *Aloaceae, Anti-hyperglycemic activity, Phytochemical*

Introduction

Diabetes mellitus is one of the most common endocrine disorders in all populations and all age groups. There is a rising prevalence of the disease in the developing countries with industrialization, socio-economic development, urbanization and changing life style (Zimmet, 1992; WHO, 1998). In year 2000, according to the WHO, at least 171 million people worldwide suffer from diabetes. WHO Regional Office for South East Asia 2009 website states, health situation in the South-East Asia Region (1998-2000), the estimated number of cases is 40,610,925 in Population of 1,489,132,000 i.e 2.7 percentage of population (WHO Regional Office for South East Asia 2009). By 2030, it is estimated that the number of people with diabetes >64 years of age will be >82 million in developing countries and >48 million in developed countries. (Wild et.al., 2004). In case of Nepal too, according to S.Haruka et.al there is a surprisingly rapid increase in the prevalence of diabetes in the Nepalese population. The study found 9.1% in urban areas and 1.3% in rural areas. This appears to have been influenced more by rapid urbanization and changes in lifestyles after the ongoing democratic movements that have taken place since 1990 in Nepal.

Currently various therapies are practiced to treat Diabetes Mellitus in case of either type 1 or type 2. For treating Type 2 diabetic patients, when patients fail to maintain normoglycemia by maintaining diet and exercise alone, the first line drugs are the oral hypoglycemic agents like Sulphonylurea, Biguanides, thiozolidinedions, Meglitinides, Metformin, Glipizides and Glimipirides are the drug of choice. Considering the limitations of existing therapies in restoring the quality of life to normal and reducing the risk of chronic diabetic complications, there is a clear need for the development of alternative strategies for diabetes therapy.

Nepal is regarded as one of the main country with rich sources of medicinal plants. The region is being blessed with a rich biodiversity with varieties of flora and faunas. In Nepal about 80% of population still relies on herbal medicines for their first and basic health care especially those people living in remote areas. So, there is a belief that their health problems can be solved through scientific exploitation of medicinal plants available in their country to great extent.

The selected plant *Aloe vera* belonging to the family of Aloaceae is widely cultivated throughout the

world. *Aloe vera* is a perennial succulent xerophyte, with elongated pointed fleshy leaves consisting of two parts, an outer skin (green rind) and inner pulp (colorless mucilaginous gel). *Aloe vera* has been reported to be effective in various ointments such as burns, allergic reactions, rheumatoid arthritis, rheumatoid fever, indigestion, ulcers, diabetes, skin disease, diarrhoea, piles etc.(Lanjhiyana et al., 2011).

Materials and Methods

Collection and Identification of plant

The leaves of *Aloe vera* plant was collected from Kathmandu valley locally. The plant was identified by the Department of Plant Resources, Thapathali, Kathmandu, Nepal.

Preparation of plant extract

The collected leaves of *Aloe vera* were cleaned, crushed and grinded by using an electric blender. Each (gm) powder was then extracted with 80% ethanol and distilled water, respectively soaking it 24 hours in solvents separately. Each extract was filtered and concentrated by using Rota rod instrument.

Phytochemical screening

Qualitative phytochemical tests of each extract were carried out to determine the presence or absence of following glycosides, alkaloids, flavonoids, tannins, terpenoids, saponin, reducing sugar using standard methods.

Animals and Experimental Design

Adult healthy albino rats of either sex weighing 180-220 gms were used through out the study. The animals were maintained at a constant room temperature of 22±5^{0}C with humidity of 40-70%. Animals were handled according to the national guidelines of Nepal government.

Induction of Diabetes

Diabetes was induced in animals by intraperitoneal injection of Alloxan monohydrate 150mg/Kg body weight. After two hour of Alloxan injection, dextrose 10% was fed with distilled water to prevent animals from hypoglycemia. After 7 days of Alloxan induction, fasting blood glucose levels of >250 mg/dl were considered as diabetic and selected for further study. Their blood glucose levels were estimated in 0th day and then in 15th day and 28th day.

Treatment schedule: All the rats having blood glucose level >250 mg/dl, were randomly divided into 4 groups of 6 animals each and treated once daily for 28 days.

i) diabetic control receiving water (wc)
ii) diabetic treated with Glibenclamide (5 mg/kg bw)
iii) diabetic treated with water extract of *Aloe vera* (Gel-W1.25 g/kg bw)
iv) diabetic treated with ethanol (80%) extract of *Aloe vera* (Gel-Et1.25 g/kg bw).

Both extracts at the dose (1.25 g/kg bw) & glibenclamide (5mg/kg bw) were fed once a day to each rat of each group for 4 weeks. Fasting blood glucose level of alloxan induced diabetic rats of each group on 0th, 14th and 28th days were determined by pre-standardized Glucometer with reagent strips.

Statistical analysis

Data from the experiments were analyzed using the Statistical Package for Social Science (SPSS) version 19. All the data were expressed as Mean ± SD or as Median (Range) as appropriate. The limit of significance was set at $p<0.05$.

Results and Discussion

Phytochemical screening

The phytochemical screening of the both ethanolic and aqueous extracts of *Aloe vera* revealed the presence of cardiac glycosides, tannins, saponins, terpenes and flavonoids.

Anti-hyperglycemic effect

Alcoholic and aqueous extracts of *Aloe vera* and standard drug showed the reduction of fasting glucose level on the 14th day of the experiment with respect to water control in alloxan induced diabetes

Table 1: Anti-hyperglycemic Effects of *Aloe vera* extracts in Alloxan-induced Diabetic rats

Group	Glucose (mmol/l) 0 day	Glucose (mmol/l) 14th day	Glucose (mmol/l) 28th day
WC (n=7)	8.61±0.83	7.17±0.90	8.41±0.79
Gliben (n=7)	7.38±0.98	6.55±1.04	6.55±1.04
Water Ext (n=7)	7.56±1.50	7.07±1.21	6.39±1.81
Ethanol Ext (n=7)	7.74±1.16	6.66±0.98	6.42±1.93

in rats. Reduction of fasting glucose level on 28th days of experiment by extracts and standard drug were found more significant compare to the fasting blood glucose level of 0^{th} and 14^{th} day of the experiment.

Effects of Four weeks treatments of Alloxan - induced Diabetic Model rats with aqueous and ethanol extracts of *Aloe vera* gel on fasting blood glucose levels .

The extracts of 1.25g/Kg BW post oral, showed reduction of raised blood glucose level in alloxan induced diabetic rats and maximum reduction was found on 28th day indicating the extracts had a significant antidiabetic activity in rats. The possible mechanism through which the extract might have brought about blood glucose lowering effect were either by increasing utilization of glucose or by direct stimulation of glucose uptake through increased insulin secretion. It might also have been due to the extracts stimulating β cells in islet of Langerhans, increased serum insulin and reduced blood sugar. The findings also suggest that plant extracts may regenerate β cells and has protective effect on β cells from glucose toxicity. As other studies showed, plant extracts might bring about its hypoglycemic effect through insulin secretion from the remaining β cells and insulin sensitivity. The blood glucose lowering effect of these plant extracts may be attributed to the presence of phenols, flavonoids, alkaloids, tannins, phylobatanins, and saponins that have been associated with hypoglycemic activity. Flavonoids are one of the most numerous and wide spread groups of phenolic compounds in higher plants. Some of them, due to their phenolic structure, are known to be involved in the healing process of free radical mediated diseases including diabetes resence of saponins in this extract could also be responsible for the hypoglycemic activity.

Conclusion

As *Aloe vera* extracts showed anti-hyperglycemic activity in alloxan induced diabetes in rats, further investigation is needed to isolate the compounds responsible for anti-diabetes effect to develop drugs.

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