**INTRODUCTION**

*Vetiveria zizanioides* (L.) Nash (family: Poaceae) is commonly known as 'Khas-Khas' in Bangladesh and India. It is a perennial grass with thick fibrous adventitious roots. This species is native of the Indian subcontinent and has been introduced in many tropical countries. Roots are stimulant, tonic, cooling, stomachic, diuretic, antispasmodic and emmenagogue and used in fevers, inflammations and irritation of the stomach. Essence of the root is used to check vomiting in cholera. Smoke of grass is inhaled to relieve headache. Apart from its use as an insect repellent and soil erosion management tool, vetiver grass has numerous traditional uses such as root paste for headaches and leaf paste for rheumatism and sprains. Commercial uses of vetiver grass mainly pertain to the extraction of vetiver oil through distillation of the roots. Vetiver oil has extensive applications in the soap and cosmetic industries, food flavouring and is also used as an antimicrobial and antifungal agent in the pharmaceutical industry. This oil is principally used in high class perfumery where its persistent odour makes it of great value as a fixative in admixture with other perfumes. Vetiver grass is also cultivated for the production of a commercially important essential oil used in perfumery and aromatherapy. Various tribal people in the subcontinent use different parts of the grass for many ailments such as mouth ulcer, fever, boil, epilepsy, burn, snakebite, scorpion sting, rheumatism, headache, etc. Over 150 compounds have been isolated and characterized from vetiver oil so far. The complex odour of vetiver oil is dominated by a woody balsamic tonality of a very special kind. This tonality indicates the presence of some volatile compounds that have been reported to be mainly sesquiterpenes and their derivatives. Among these, the major active constituents identified are khusimol, vetivone, eudesmol, khusimone, zizaene, pr ezizaene, β-vetispirene, khusimol, vetiselinenol and α-vetivone. As, there is no report available on the literature survey regarding the antidiabetic activity, the present investigation was undertaken to determine the antihyperglycaemic effect of *V. zizanioides* root extract in alloxan induced diabetic rats to substantiate the folklore claim.
characterized by hyperglycemic, glucose urea and negative nitrogen balance and it is mainly due to lack of insulin secretion in beta cells of pancreas and desensitization of insulin receptors for insulin. It is the most prevalent disease in the world affecting 25% of population and afflicts 150 million people. It is expected to touch 300 million marks by 2025. In diabetes, hyperglycaemia generates reactive oxygen species (ROS), which in turn causes lipid peroxidation and membrane damage and these free radicals play an important role in the production of secondary complications in diabetes mellitus (kidney, eye, blood vessel and nerve damage). Herbal drugs are gaining popularity in the treatment of diabetic mellitus. The major advantages of herbal medicine seem to be their efficacy, low incidence of side effects, low cost and easily available.

The preliminary phytochemicals on ethanol extract of *V. zizanioides* showed the presence of glycosides, steroids, saponin, tannin, flavonoids and phenolic compounds.

### EXPERIMENTAL

Alloxan and glibenclamide (Merck and S.N. Chemicals, respectively) were used for these investigations. All other chemicals, solvents and drugs used were of analytical grade.

The roots of *V. zizanioides* were collected in the month of August, from the Simlipal Biosphere in the district of Mayurbhanj, North Odisha, India. The collected plant was authenticated by Botanical survey of India, Central National Herbarium, Botanical garden, Shibpur, Howrah, India, vide letter no CNH/1-1/231/2008/Tech. II/261.

**Preparation of extracts:** The roots were dried under shade and powdered to coarse particles. Two kg powdered plant materials were defatted with petroleum ether (60-80 °C) in a Soxhlet extraction apparatus and further the same plant materials was extracted successively with ethanol. The yield of the ethanolic extract of *V. zizanioides* was found 1.47% w/w.

**Phytochemical screening of ethanolic extract of *V. zizanioides***: Small amount of the dried extract (EVZ) was appropriately treated to prepare sample solution and then subjected to the phytochemical tests. The phytochemical screening of ethanolic extract of *V. zizanioides* was performed using the following reagents and chemicals: alkaloids with Dragendorff’s reagent; flavonoids with the use of Mg and HCl; tannins and phenolic compounds with ferric chloride and potassium dichromate solutions; steroids with Libermann Burchard reagent; terpenoids with tin and thionyl chloride; amino acids with ninhydrin solution and saponins with ability to produce suds; glycosides with chloroform and concentrated sulphuric acid. These were identified by the characteristic colour changes as per standard procedures.

**Experimental animals:** Wistar albino rats weighing 250-350 g of both sexes were selected for the present investigation. They were housed in clean polystyrene cages and were fed with standard pellet diet (Hindustan Lever, Kolkata, India) and water ad libitum. The animals were acclimatized to normal laboratory condition for one week before proceeding of the experiment. The experiment was performed under the guidance of the Institutional Ethical Committee.

**Preparation of drug solution:** Ethanolic extract of *V. zizanioides* was dissolved in normal saline and administered at the doses of 100, 250, 500 and 750 mg/kg body weight of rats.

### RESULTS AND DISCUSSION

**Acute toxicity study:** Acute toxicity study was performed for the extract according to the acute toxic classic method of Litchfield and Wilcoxon. The animals were divided into 6 groups containing 10 animals each. The ethanolic extract of *V. zizanioides* suspension was administered orally in increasing dose up to 1500 mg/kg, b.w. These animals were observed for mortality and toxicity for 72 h.

**Induction of experimental diabetes:** Diabetes was induced in wister rats of either sex by a single intravenous injection of aqueous alloxan monohydrate (150 mg/kg, i.v.). After 48 h of injection, animals with the serum glucose level above 200 mg/dl (diabetic) were selected for the study.

**Collection of blood and determination of serum glucose:** Blood samples were collected by cutting the tail vein of mice and blood glucose levels are checked by glucometer (Dr. Morepen, 9F, 31 codes).

**Experimental protocol:** The method described by Dunn et al.12 was adopted to determine the serum glucose in alloxan-induced diabetic rats. The diabetic rats were fasted overnight and divide into six groups of six rats each. Group-I-Vehicle (normal saline, 10 mL/kg p.o.), Group-II-Glibenclamide (10 mg/kg p.o.), Group-III-EVZ (100 mg/kg p.o.), Group-IV-EVZ (250 mg/kg p.o.), Group-V-EVZ (500 mg/kg p.o.), Group-VI-EVZ (750 mg/kg p.o.).

For acute antihyperglycaemic study, blood samples were collected at 0, 2, 4, 6, 8 and 24 h, after administration of vehicle, glibenclamide and ethanolic extract of *V. zizanioides*. Sub acute study involved administration of vehicle, glibenclamide and ethanolic extract of *V. zizanioides*. At different concentrations, the blood-glucose levels were estimated on the day 0, 2, 14, 16, 18 and 24th day. Mean changes in blood-glucose levels were calculated.

**Statistical analysis:** Results are expressed as mean ± SD. Comparison between the groups with control was made by one way analysis of variance (ANOVA), followed by Dunnett’s test. The values of *p* > 0.05 were considered as statistically significant.

Preliminary phytochemical analysis of ethanolic extract of *V. zizanioides* showed the presence of flavonoids, sterols, saponins and polyphenolic compounds.

The effects of root extract of *V. zizanioides* (L.) in normal fasted rats after multiple doses were presented in Table-1. It was observed that only ethanolic extract of *V. zizanioides* showed significant antidiabetic activity at 2 and 4 h after administration of drug compared to diabetic control. The results were comparable with reference standard glibenclamide. The results related to blood-glucose level in alloxan induced diabetic rats after the multiple dose in acute and sub acute studies are presented in Tables 2 and 3, respectively.

It was observed that only ethanolic extract of *V. zizanioides* showed more significant antidiabetic activity than other extracts of *V. zizanioides*. Ethanolic extract of *V. zizanioides* showed more significant antidiabetic activity at 2 and 4 h compared to diabetic control.

On prolonged treatment, ethanolic extract of *V. zizanioides* showed more significant antidiabetic activity at 7th, 21th and 28th day compared to control (Table-3). The results of present
experiments revealed that ethanolic extract of *V. zizanioides* has significant antihyperglycaemic activity. Effects of oral administration of ethanolic extract of *V. zizanioides* in euglycaemic rats compared with glibenclamide are presented in Table-1. Glibenclamide reduced blood sugar levels significantly and showed hypoglycaemic effects considerably.

Preliminary phytochemical analysis of ethanol extracts revealed the presence of flavonoids, sterols, saponins and polyphenolic compounds. Flavonoids and saponins containing plants were known to exhibit antidiabetic activity. *V. zizanioides* may be responsible for such activities. Isolation and characterization of some new active constituents, which may give new lead molecules for the treatment of diabetes in a more acceptable manner is the scheme for further investigation.

**Conclusion**

Based on the aforementioned results, we concluded that ethanolic extract of *V. zizanioides* has hypoglycaemic and antihyperglycaemic activity as it lower blood-glucose level in diabetic rats. However, the molecule(s) responsible for such an effect requires further investigation.

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**REFERENCES**