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Original Article

PHARMACOEPIDEMIOLOGICAL SURVEY ON THE USE OF *COSTUS PICTUS* (INSULIN PLANT) IN CENTRAL KERALA

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ABSTRACT

Objective: *Costus pictus* commonly known as spiral ginger or insulin plant is grown in gardens as ornamental plant especially in Kerala and used to control sugar levels. The objective of the present survey was to collect information on the use of this plant as a control measure for diabetes mellitus in a community in central Kerala.

Methods: The study was conducted with the help of a semi-structured questionnaire. The questionnaire broadly included questions about knowledge of insulin plant, its use, quantity and frequency of use, the relation of plant material consumption with food intake, effects related to blood sugar level and other symptoms, any discomfort or complications after use among diabetic and normal people. The data obtained was quantitatively transferred to an excel sheet and statistical analysis was carried out.

Results: From the survey, it can be inferred that *Costus pictus* is widely used to normalise their sugar level. People who are using insulin plant have not done any species identification scientifically. Due to lack of knowledge and difficulty in identification (especially in the non-flowering season), many people are using *Costus speciosus* without knowing its adverse effects and allergic reactions.

Conclusion: From the survey, it can be concluded that *Costus pictus* is widely used in some part of the community in Kerala, to normalize their sugar level. It is warranted to increase the awareness in the community about different species of Costus plant and adverse effects associated with similar species.

Keywords: *Costus pictus*, insulin plant, pharmacoepidemiological survey, diabetes

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INTRODUCTION

Diabetes mellitus is possibly the world's largest growing metabolic disease, and as the knowledge on the heterogeneity of this disorder is advanced, the need for more appropriate therapy increases [1]. In spite of the introduction of various antihyperglycemic agents, diabetes and its secondary complications continue to be a major problem in the world population. The presence of diabetes mellitus confers increased risk of many devastating complications such as cardiovascular diseases, peripheral vascular diseases, and complications such as coronary artery diseases, stroke, neuropathy, renal failure and blindness. Medicinal plants and their bioactive constituents are used for the treatment of diabetes throughout the world, especially in countries where access to conventional anti-diabetic agents is inadequate. Many indigenous Indian medicinal plants have been found to be useful to manage diabetes [2-3] successfully.

Costus pictus D. Don (Costaceae) commonly known as spiral ginger, stepladder or insulin plant is originated in Mexico. This is a newly introduced plant in India and it is grown in gardens as ornamental plant especially in Kerala [4]. The flowers of this plant are yellow, lip with maroon striations, darker yellow stripe down the middle region [5]. In southern India, it usually grows as an ornamental plant in the garden and its leaves are used by local peoples to control their blood sugar levels. A number of researches have been carried out to evaluate the antidiabetic potential of this plant. Besides, it has been proven to possess various pharmacological activities like hypolipidemic, diuretic, antioxidant, anti-microbial, anti-cancerous [6]. Another study showed that methanol extract of *Costus pictus* leaves showed anti-diabetic effects in alloxan-induced diabetic rats [7]. Antihyperglycemic effect of *Costus pictus* extract and its fractions is reported in alloxan induced diabetic rats [8-9]. Studies have revealed that aqueous extract of aerial part of *Costus pictus* induces a natriuretic response similar to that of furosemide [10]. Genomic analysis of *Costus pictus,* was done by Annadurai *et al.* and reported transcripts related to pathways of bixin biosynthesis and geraniol and geranial biosynthesis as major transcripts from the class of isoprenoid secondary metabolites and validated the presence of putative norbixin methyltransferase, a precursor of bixin [11]. *In vitro* evaluation of anti-diabetic activity of leaf and callus extracts of *Costus pictus* was done by sidhu *et al.* [12]

Gene and protein expression of key targets in insulin signaling and adipogenesis pathway revealed that methanolic extract of *Costus pictus* exhibited antidiabetic activity along with anti-adipogenic activity [13]. These findings have revealed the anti-diabetic potential of *Costus pictus.* Geerish *et al.* suggested that glucose lowering effect of *Costus pictus* was associated with the potentiation of insulin release from pancreatic islets and peripheral utilisation of glucose [14]. Jayasri *et al.* reported that *Costus pictus* extract has inhibitory effect on carbohydrate hydrolysing enzymes like α-glucosidase and α-amylase [15]. *In vitro* antioxidant activity was screened by Aruna *et al.* using various methods such as, scavenging of 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical, nitric oxide scavenging activity assay, total antioxidant activity by phospho- molybdenum method and ferric reducing antioxidant power assay (FRAP), etc.

Pharmacoepidemiology is a new bridge science drawn from the disciplines of pharmacology, therapeutics, epidemiology and statistics. Pharmacoepidemiology can make substantial contributions to our knowledge and understanding of medical, social and economic aspects of drug markets [17]. Apart from the antidiabetic studies in animal models, any pharmacoepidemiological study on the use of insulin plant among the community for its effects, a method of use, complications, etc. has not been documented yet. The primary objective of the survey was to collect information on the use of insulin plant as a control measure for diabetes mellitus in a community. Since this is the first pharmacoepidemiological survey on *Costus pictus*, a small population was included. The subjects included mainly diabetic patients who were using/who had used insulin plant and persons who are aware of insulin plant. Another object is to find any undesired effects associated with the use of insulin plant among diabetic and normal people. The present study reports a pharma-

coepidemiological survey on *Costus pictus* in central Kerala region including diabetic and non-diabetic populations.

MATERIALS AND METHODS

Study population and data collection

The study was conducted between May 2012 to September 2012 in Angamaly, Ernakulam, Kerala. We have undertaken the survey and collected addresses of 120 subjects (out of that 117 interviewed). The subjects were interviewed face-to-face, and their replies were noted down in their own words. The study purpose was explained them and interviews were performed after obtaining their consent. All the persons were native to Kerala only.

Questionnaire

The questionnaire was made in very simple language to make it suitable in the Indian context. We prepared 30 questions and the answers are coded as 1,2,3 etc. It was translated from English into local language (Malayalam) by a professional experienced in translating health survey questionnaires. The translated version was back-translated into English by an independent person followed by a review to control for possible discrepancies. The final translated version evolved following an interactive process, which included pilot testing and incorporating appropriate changes. The information collected from the respondents (diabetic as well as normal person) include knowledge of insulin plant, its use, quantity and frequency of use, relation of plant material consumption with food intake, effects related to blood sugar level and other symptoms like fatigue, change in weight, thirst or urination etc., any discomfort or complications after use among diabetic and normal peoples.

Statistical analysis

The data obtained was quantitatively transferred to an excel sheet, and descriptive statistics (number and percentage) of the difference between the groups (normal and diabetic) was tested by Chi-square test. The findings were illustrated by the graphical presentation and p value ≤ 0.05 was taken as the level of significance.

RESULTS

Total of 117 subjects participated in the study which included 63 males and 54 females. Among this 82.1% subjects were having diabetes and 17.9% were normal subjects. Regarding age, 38 were below 50 y of age, 30 subjects were 50-60 y, 29 were between 60-70 and 20 subjects were above 70 y of age.

Knowledge about insulin plant

Knowledge about the insulin plant includes whether the participants heard about insulin plant, heard it is good for diabetes from newspaper/TV or people, know people using it/already using it etc.

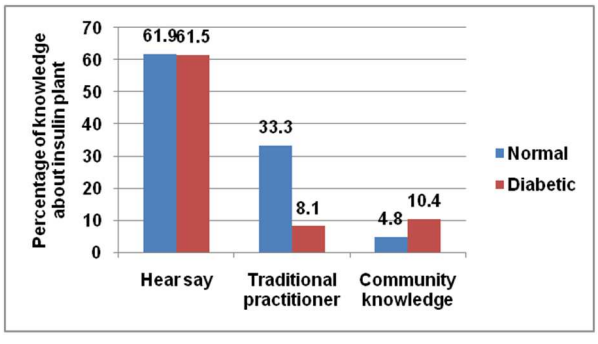

Fig. 1: Knowledge about insulin plant

One interesting feature noted during the survey was that 62% subjects in both the groups came to know about insulin plant by hearsay, 33% among normal and 8% among diabetic persons from the traditional practitioner and 5% among normal and 10% among diabetic persons from community knowledge. With respect to knowledge of insulin plant, there was no statistically significant difference (P=0.688) between normal and diabetic people (fig. 1).

Reason for the use of insulin plant

16.7% among normal and 70.7% among diabetic people used insulin plant for a beneficial effect on blood glucose and the number of normal people who used it for prevention of diabetes was 83.3 % and 29.3% among diabetics (fig. 2). The difference in the proportion was statistically much significant (p<0.001).

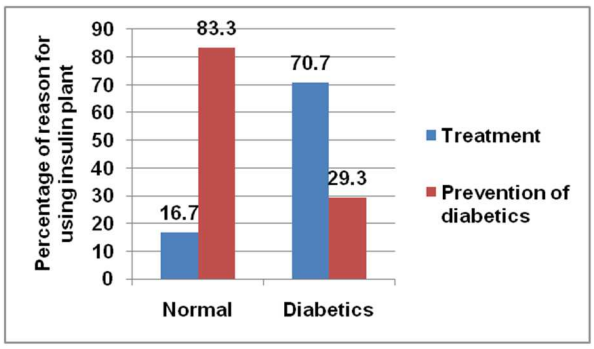

Fig. 2: Reason for the use of insulin plant

Source of plant

The major source of plant was local area (75% among normal and 76% among diabetics), followed by nursery (25% among normal and 19.2% among diabetes people) and from their own garden (5.4% diabetic people) No significant difference in sources among normal and diabetic people (p>.05) was found (fig. 3).

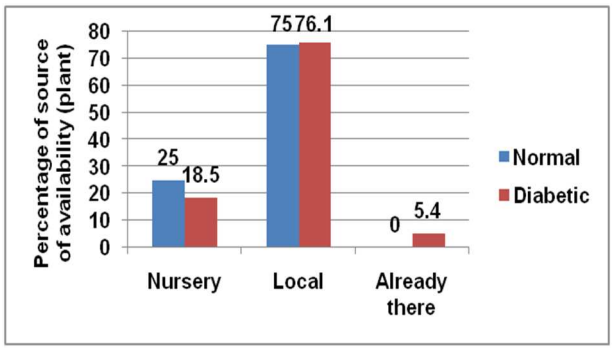

Fig. 3: Source of plant

Identification of plant

Regarding identification of the plant, nearly 70% among diabetic people confirmed it is insulin plant compared to 76% among the normal. However, this difference was not found to be statistically significant (p>0.05) (fig. 4).

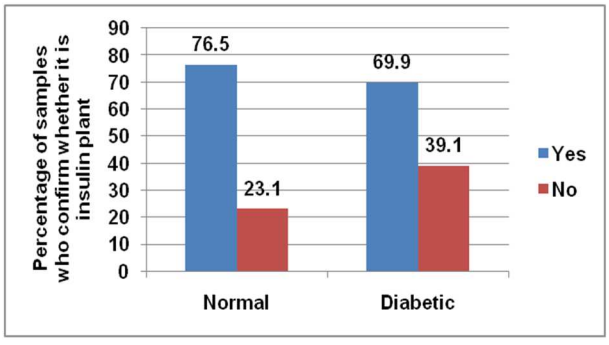

Fig. 4: Identification of plant

Form of intake

Most of the diabetic persons (88%) used leaves of the plant as such compared to 71% among the normal group. No significant difference was noticed between normal and diabetic populations (p>0.05). Other forms of using insulin plant were found to be much lower among diabetic people as well as normal people (fig. 5). The percentage of peoples using leaves as such was very high (88%) as compared to use in other form. The rason may be the convenience of use and satisfactory benefit from leaves itself.

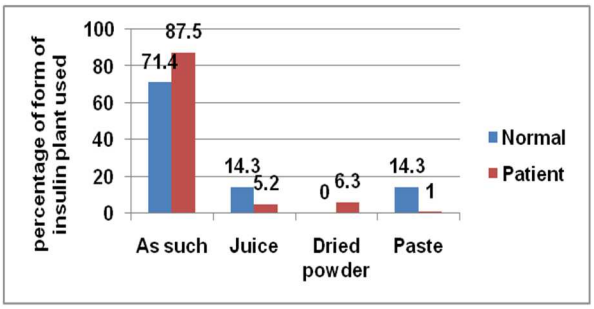

Fig. 5: Form of use of insulin plant

Frequency and time of use

Among the total cases studied 86.1% people used insulin plant daily and 13.9% people used it occasionally. No significant difference was noticed among normal and diabetes people (p>0.05). Among diabetic patients, about 92% used insulin plant in the morning compared to 60% among normal. Other time of use was much less except the random time use (25% among normal) and 15% of normal in the evening (fig. 6). Here the difference between groups (diabetic and normal) was statistically significant (p<0.01).

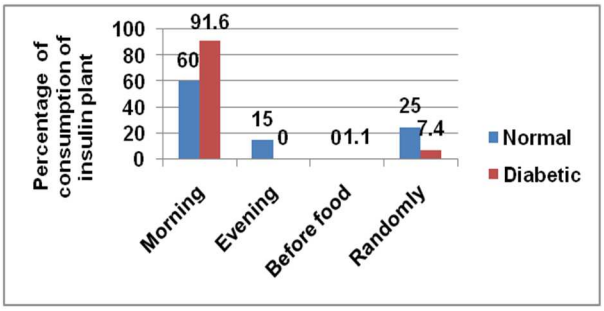

Fig. 6: Time of use of insulin plant

Dose of the plant material

78.9% subjects were taking one leaf daily while 21.1% people had two leaves daily. There were 79.1% subjects which responded that the plant has to be taken before food. Among these 84.2% were diabetic and 55% were normal. 19% subjects said that there was no relation with food intake and 2% people told, the plant has to be consumed after food (fig. 7). Here the difference between groups (diabetic and normal) was statistically significant (p<.01).

Observations noticed after consumption of plant

Decrease in the frequency of urination was reported by 100% among normal and 93% among diabetic while 6.9% subjects said that there was no change in the frequency of urination after taking insulin plant (fig. 8). Decrease in the thirst was reported by 79.2% subjects while 19.4% subjects did not experience any change in thirst after taking insulin plant (fig. 9). Decrease in hunger was reported by 25 (34.7%) subjects while 46 (63.9%) people said that there was no change in hunger after taking insulin plant (fig. 10).

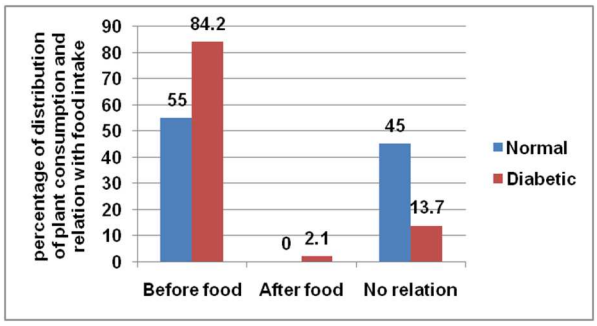

Fig. 7: Relation of plant consumption with food intake

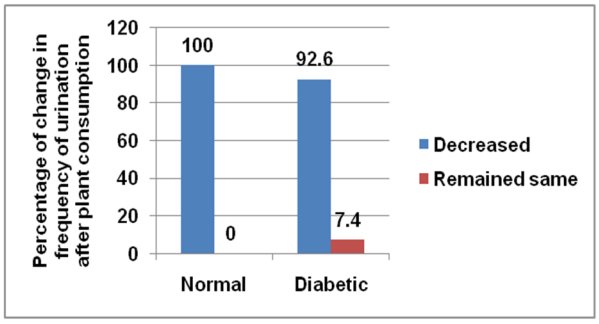

Fig. 8: Frequency of urination

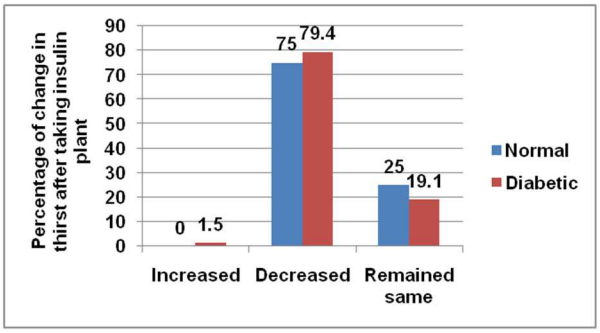

Fig. 9: Change in thirst

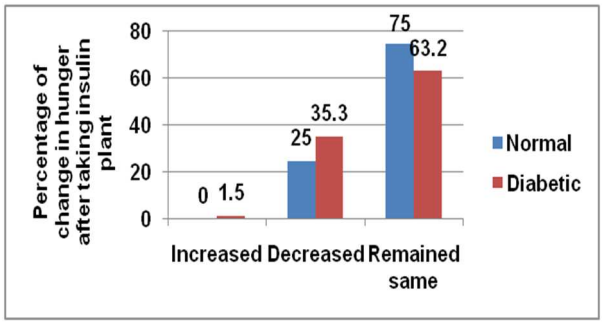

Fig. 10: Change in hunger

The decrease in the fatigue was reported by 80.6% subjects while 19.4% subjects said that there was no change in fatigue after taking insulin plant. The decrease in the weight was reported by 43.1% subjects while 51.4% peoples said that there was no change in weight and only 5.6% person noticed an increased in the weight after taking insulin plant (fig. 11).

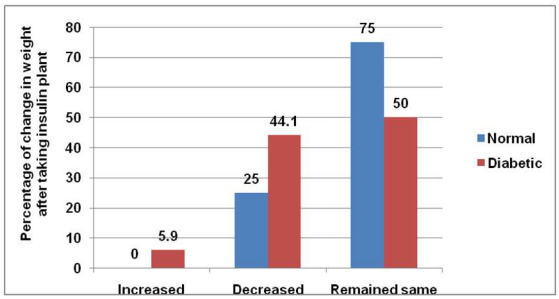

Fig. 11: Change in body weight

Effect on blood sugar level

Decrease in the fasting blood sugar was reported by 95.8% subjects (98% among diabetics and 50% among normal) (fig. 12). In the case of postprandial (2 hr after food) sugar level 70.8% subjects noticed a decrease in blood sugar 2 h after food and 29.2% subjects responded that there was no change in blood sugar 2 h after food (fig. 13).

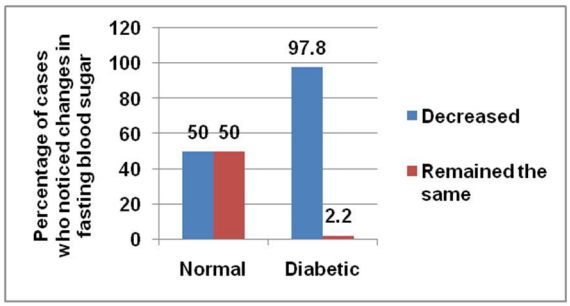

Fig. 12: Change in fasting blood sugar

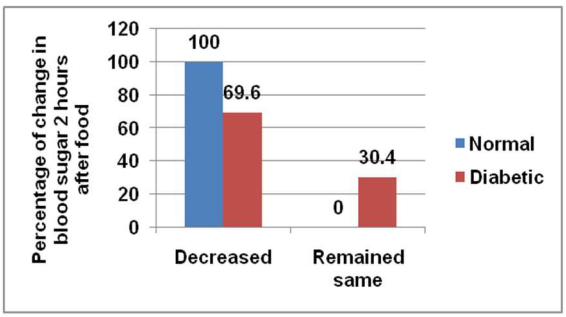

Fig. 13: Change in postprandial blood sugar

In the same way, a decrease in the random blood sugar was reported by 77.1% subjects while 22.9% people said that there was no change in random blood sugar after taking insulin plant (fig. 14).

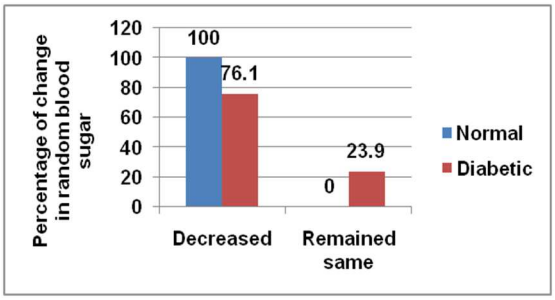

Fig. 14: Change in random blood sugar

Duration of intake

About 66.7% subjects used the plant for few weeks (100% among normal and 65% among diabetics). Among diabetics 24% used the plant for months, 8.8%) subjects used it for years and 2.9% subjects used the plant for more than one year (fig. 15). Out of 72 people, 71 subjects responded that there was a progressive improvement in their health over a period of use while 1 subject said that there was progressive deterioration over time.

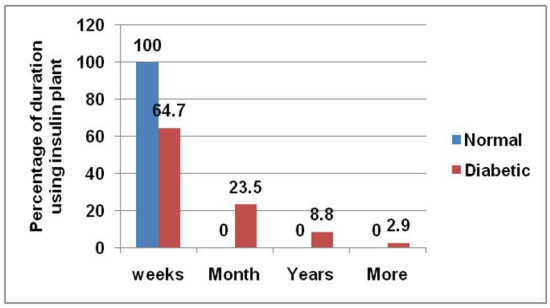

Fig. 15: Duration of use of plant

Adverse effects

Any adverse effect or discomfort was not reported by the majority of subjects (100% among normal and 76% among diabetics) after taking insulin plant whereas 23% among diabetics reported some complications which were related to abdominal problems like gastric discomfort and acidity (fig. 16).

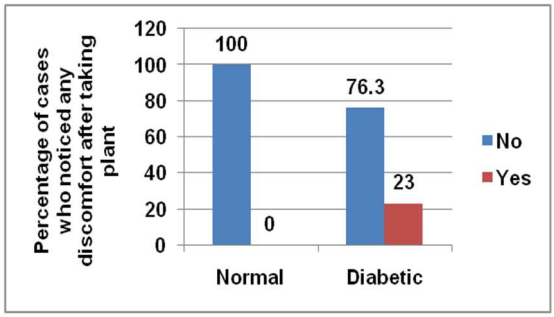

Fig. 16: Adverse effects noticed after use of plant

More than three-fourth subjects (76.9%) in the study were agreed that insulin plant was beneficial for prevention and treatment of diabetes while 23.1% people did not agree to this.

DISCUSSION

Great efforts have been made by developed countries to control infectious diseases, but non-communicable diseases have not received much attention. Diabetes mellitus is one of the non-communicable diseases which have become a major global health problem. The International Diabetes Federation (IDF) estimated that there are 100 million people with diabetes worldwide that is about 6% of all adults. As per World Health Organization (WHO), in Asia, the prevalence of diabetes is high, and it has been estimated that 20% of the current global diabetic population resides in South-East Asia. Indeed, the number of cases in India is likely to reach 69.9 million by 2025.

This is the first pharmacoepidemiological study on the use of *Costus pictus* among diabetic peoples in Kerala. This study revealed that leaves of *Costus pictus* are being used by peoples living in Kerala to normalize the blood sugar level. Some normal people are also using this plant for the prevention of diabetes. One important finding is that the people are not much aware of various species of Costus plant and didn't identify the correct species before use.

Most of the people preferred to take the leaves as such in the morning. More than three forth people noticed a decrease in urination and thirst after use of this plant. About 97.8% people noticed a decrease in fasting blood sugar and more than 70% people found a decrease in postprandial sugar level. One of the interesting features is that some people are using this plant from last several years as an aid to manage their diabetes.

Another important finding is that more than three-fourth (about 77.8%) people did not notice any side effects or complications after consuming the plant. Some people reported gastric discomfort and acidity which may be due to a high dose of the plant material.

This study has given us a lot of information about the use and various effects of insulin plant. Some of these effects agree with the findings already reported in literature about its properties. People who are using insulin plant have not done any species identification scientifically. Due to lack of knowledge and difficulty in identification (especially in the non-flowering season), many people are using *Costus specious* without knowing its adverse effects. Botanical identification of plant is necessary to avoid adverse events and allergic reactions caused by the plant. The adverse effects of the drug reported from the literature include acidity and hypoglycemia.

Costus pictus can be used as a preventive for diabetics or can be used to alleviate its effects. Due to lack of scientific studies reported with *Costus pictus*, it is difficult to say about the mechanism and active constituents present in the leaves. The detailed scientific study is warranted to explore the mechanism of antidiabetic activity and also to isolate the active portions/constituents. Toxicity study will also help to know the adverse effects and to find out the culprits present in the plant responsible for adverse effects.

CONCLUSION

This is the first pharmacoepidemiological study on the use of *Costus pictus* among diabetic people in Kerala. From the survey, it can be concluded that *Costus pictus* is widely used in some part of the community in Kerala, to normalize their sugar level. It is warranted to increase the awareness in the community about different species of Costus plant and adverse effects associated with similar species. This pharmacoepidemiological study will definitely help us to decide our direction of research and methodology to be used to explore the benefits of the plant in a scientific way and to develop an extract/formulation devoid of any adverse effects.

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CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest

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