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RESEARCH ARTICLE

Study of Ethnomedicinal Plants used against Diabetes by the Tribes of Gajapati district of Odisha

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Abstract

The original roots of complementary medicine continue to be found in India, where it is still widely used in public healthcare. Due to the significant rise in frequency in India, diabetes mellitus has recently attracted attention. It is characterized by an increase in blood sugar levels over the threshold and an overflow of added sugar into the urine. The purpose of this research is to look into the traditional medical knowledge of plants used to cure diabetes in the Gajapati district of Odisha. Interactions with the Savara, Shaber, Kandha and Lodha tribes of the district were used to gather information on the anti-diabetic plants. Interacting with the traditional medicine men allowed researchers to chronicle the indigenous knowledge of the plants' anti-diabetic qualities. There are 19 plants in all, spread across 14 families, which have been identified as being used to treat diabetes mellitus. The medicinal plant belonging to the family of Euphorbiaceae, Cucurbitaceae, Araceae, Caesalpiniaceae, Apocynaceae and Polypidiaceae are the most frequently used. Roots and leaves were the most frequently used, and decoction extracts were most frequently employed. Our research found a large number of these plants and the products they produce. With more thorough research, the future of diabetes treatment may be promising. For these plants to become recognized as secure and efficient anti-diabetic drugs, additional clinical and pharmaceutical intervention investigations are required.

Keywords

Public health, ethnomedicine, diabetes mellitus, complementary medicine, antidiabetic

Introduction

Diabetes mellitus is a widespread and serious metabolic illness that has a significant global impact. Nearly 25% of people worldwide, according to estimates, have diabetes (1). It is regarded as one of the main causes of death on a global scale (2). A report from 2020 states that diabetes causes over 11.3% of fatalities worldwide, with nearly 46% of those deaths occurring in people under the age of 60 (3). By 2030, the number of deaths is predicted to grow by two to threefold (4). Sedentary behaviors, a modern lifestyle, an imbalanced food, etc. are the main causes of the onset of diabetes.

Diabetes mellitus is characterized by dysregulation of lipid and glucose metabolism as a result of reduced insulin production or activity.

Type I diabetes, also known as insulin-dependent diabetes mellitus and type II diabetes, also known as non-insulin-dependent diabetes mellitus, are the two main types of the disease. Type I diabetes results from the loss of pancreatic beta-cells, whereas type II diabetes develops when the body is unable to properly use insulin (5). If left unchecked, it can cause long-term damage to the nerves and blood vessels, resulting in problems like retinopathy, nephropathy and cardiopathy (6). Patients with diabetes must contend with a number of obstacles, such as lack of access to healthcare facilities, financial challenges, inadequate information provided by healthcare professionals and unfavourable attitudes (7). The available therapy, which is linked to substantial side effects, is another important restriction. Thus, there is a need to research and learn about the many native plants, as well as several herbal remedies that can treat diabetes (8).

The World Health Organization (WHO) has recently endorsed a significant number of herbal medications for the treatment of diabetes mellitus. More than 800 species have been identified in the ethnomedical literature as having hypoglycaemic action (9). The WHO recommended using these plants to control diabetes mellitus and also encouraged expanding scientific research on the hypoglycaemic characteristics of other plant species (9). Numerous positive reviews in recent years have maintained the effectiveness of numerous herbal diabetic treatments (10, 11).

The main goal of this study was to conduct an exhaustive inventory of all anti-diabetic plants used by the different tribes in the Gajapati district of Odisha.

Materials and Methods

A total of 3850 square kilometers makes up the Gajapati district. In the tribal areas, the temperature ranges from 10 to 37 °C, while in the plain areas with a very humid climate, the temperature ranges from 16 to 39 °C. Nearly 60% of the area is made up of high, mountainous terrain that is ideal for gardening. The other cultivable lands are medium and lowlands, which account for 20% and 15% of the total area, respectively. The predominant soil types in the area are clay and sandy loam and the soil is a light-textured, brown forest soil. Thus, it is evident that agriculture generates the majority of the income. It is located between 83.48° and 84.08° east longitudes and 18.6° and 19.39° north latitude.

In the district, a thorough survey was conducted for the collection, documentation and characterization of plants used to treat diabetes mellitus.

Collection of Medicinal Plant:

A tool for gathering specimens that is used to dig up the roots and rhizomes of herbaceous plants. Cutting branches and other plant components occasionally requires the use of a powerful knife or machete, a set of secateurs or pruning shears for chopping hard and woody stuff, a set of forceps for studying flower buds, a vasculum for holding gathered samples, a plant press for pressing and storing the collected specimens, with blotters or newsprint, extra blotting paper in many sizes (blotters), a completed field diary for recording the specifics or tags made of thin aluminum or tin. The tag is assigned a number and fastened to the field specimen. This number should match the page number in the field book. Gathering bags or polythene are practical containers for specimens of fresh plants. To prevent plant material from wilting, the opening of the bags should be tightly closed after storing plants in them.

Storage of Medicinal Plant:

When specimens are complete in every way, they are kept in wooden or steel almirahs for safekeeping and future documentation. In essence, these almirahs are built with two to three tiers of pigeon holes. Following identification, the specimens are placed in almirahs in accordance with any internationally recognised system of plant categorization. Every species is maintained in a folded species cover that is smaller and lighter than a genus cover. In a genus cover, many species of the same genus are housed together. The name of the genus is typically written or printed over the genus cover. The specimen should be included (filed) in the herbarium after being identified.

Labelling:

Herbarium sheets are finished off by adding a label to the lower right corner once the specimen has been mounted. The label is 10 x 5 cm in size, however it may differ by 1 cm on either side.

Identification of the plant

Information was gathered about the plant parts used, formulation or application techniques employed, and the pest(s) that the plant species were used to combat during the survey. During meetings with the farmers or herbalists present, samples of various plants were gathered from the neighbouring bush and from the fields. Senegal's illustrated flora (12) was used to verify species names.

Additionally, some evidence was gathered from patients who received dosages of diabetes medications. The Department of Botany at the Centurion University in Bhubaneswar, Odisha, gathered, identified and deposited the voucher specimens as herbarium samples. Based on discussions with knowledgeable elders from the tribal communities, herbalists, and local medicine men, these plants have been catalogued. The questionnaire and interview results were used to create the plant list.

Preservation of Specimen:

The samples were stored at room temperature for at least 48 hrs after being frozen to -18 °C or lower. In order to ensure that centers of thick specimens and specimens in the middle of huge bundles are lowered to a low temperature for long enough to kill all pests, it was required in practice to freeze specimens in residential deep freezers in bulk and/or in boxes for 72 hrs. To prevent moisture from forming on the sheets as they thaw, bundles of specimens should be wrapped in plastic bags.

Alternatively, dry air was blown around the bundle in a desiccating cabinet while it is being warmed.

Documentation:

Documentation was completed based on the data that included name, family and species of the plant, habitat, locality from where it was collected and name of the collector. Number of the plant, often known as a serial number, or the name, year, and number of the collector, Species of plant (as far as known – even if only to family). Province, or other significant nation divisions you choose Locality is the name of the location, together with its distance and direction from a recognised or recognisable location. Habitat, altitude in meters.

Results and Discussion

The investigation's objective was to disclose (clarify) the tribal people's traditional medical methods. There were records of the list of plants, the portions used, the manner of treatment, the preparation techniques, and the administration techniques (Table 1).

Secondary metabolite levels are influenced by both genetics and the environment. The term for the secondary metabolites is because they were developed by plants to ward off diseases or herbivores like insects and mammals. Plants that grow in poor soil or under difficult conditions frequently rely more on specialised chemical defences. The hard, extremely low and high temperatures that the plants must grow in may result in the presence of PSMs with a variety of intriguing actions.

According to a study, *Euphorbiaceae* family is well-known among the indigenous population for its medicinal value. *Euphorbia hirta* is frequently used to treat wounds is frequently used to treat wounds. This plant has already been found to have a number of pharmacological qualities, including antiseptic, anti-inflammatory, antidiabetic, antispasmodic, antibacterial, antiviral, antifungal, anticonvulsant, nootropic, antifertility and aphrodisiac effects (13). According to a study, several Cucurbitaceae species are utilised in the area to treat various diseases in either the same way or a different way depending on the species. The most widely used plant components prepared through decoctions and used to treat diabetes and coughs. Species of the Cucurbitaceae are used in traditional West African medicines (14). A study conducted in Indonesia also stated that several plants belonging to the family of Araceae is used as a complementary treatment for diabetes (15). In a study conducted in Tamil Nadu stated that species belonging to the family of Caesalpiniaceae and Apocynaceae have shown as an alternative and effective medicine for the treatment of diabetes (16).

It was also seen that the plants that were used mostly consisted of herbs (Fig. 1). In addition to contributing to species conservation, this element has made it simpler to survey and gather plant material.

In comparison to harvesting roots, tubers, or the entire plant, collecting and preparing, processing leaves is simple and does not significantly harm the plant. The current study may have identified a significant number of candidate plants with folklore claims that require further study for use as anti-diabetic remedies.

The above results shows that medicinal plants belonging to the family of Euphorbiaceae, Cucurbitacea, Araceae, Caesalpiniaceae, Apocyanaceae and Polypodiaceae were most frequently used for the treatment purposes. The locality that had the most numbers of medicinal plants was Rayagada. It was also seen that most of these plants were herbs and could be consumed in the form of decoction, juice, paste, powder infusion, leachates, pulp or raw.

Conclusion

None of the available allopathic drugs can now treat diabetes and most of them have severe adverse effects. The secret to a more secure diabetes management strategy may lie in complementary medicine. Numerous such plants and the goods they produce were identified in our study as being used by the tribes in the Gajapati district. The future of diabetes treatment may be bright with more in-depth studies.

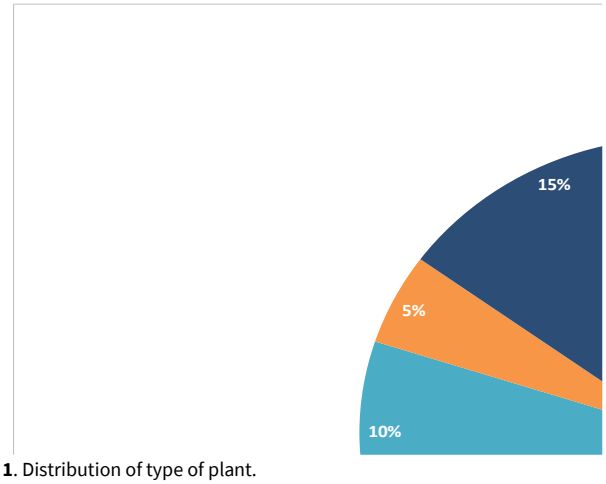

Fig. 1. Distribution of type of plant.

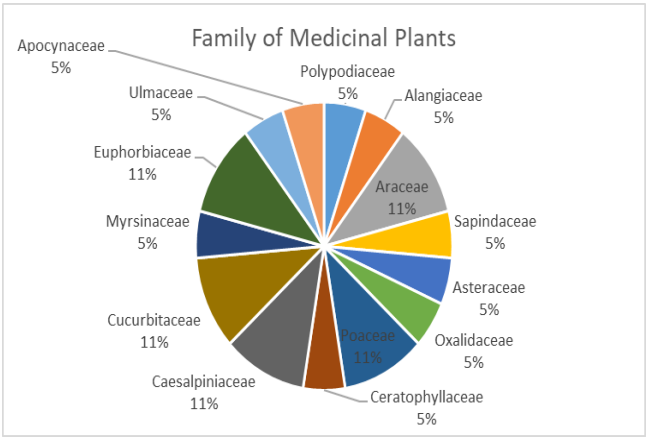

Fig. 2. Statistical presentation of different Plant families.

Table 1. Distribution of medicinal plants used for the study

Name	Locality	Local name	Family	Part Used	Possible toxic Part of the plant	Plant Description	Mode of use
Actinopteris dichotoma Bedd.	Gumma	Mayura chulia (O)	Polypodiaceae	Entite Plant	-	Small palm-like herbaceous fern.	To lessen frequent urination, 4 g of a whole plant's paste along with 4 black pepper (*Piper nigrum*) and 4 g of dried ginger powder (*Zingiber officinale*) was consumed daily for 5 days
Alangium salvifolium (Linn.f.) Wang	Nuagada	Dhela (S)	Alangiaceae	Leaf	Flower	Miniature shrubs or trees	To lower urine sugar, leaf leachate (5–15 ml) is orally administered daily (Field no. SJ- 1605).
Acorus calamus Linn.	Rayagada	Bacha (O)	Araceae	Rhizome, root	Berries	Scented marshy herbs	When combined with old jaggery (2-3 g), rhizome or root powder (3 g) is effective against diabetes-related obesity (Field no. SJ-1990).
Cardiospermum halicacabum Linn.	Rayagada	Karavi/Phutiphutika /Kanaphuta (O)	Sapindaceae	Root	-	Climber herbs with tendrils	Patients with diabetes are advised to take root powder (1–3 g) to prevent weight (Field no. SJ-1021).
Biden spilosa Linn.	Mohana	Bana gendu (M, O); Huring surgujiaba (M)	Asteraceae	Leaf	Seed	Annual herb	To treat eye issues brought on by severe diabetes, leaf juice (5 ml) should be taken three times per day for two days (Field no. SJ-1020).
Biophytum sensitivum (L.) DC	Kashinagar	Lokchanna (O)	Oxalidaceae	*Leaf*	Milky latex	*Small, tufted herb*	Diabetic patients receive a leaf decoction on an empty stomach to lower blood sugar levels (Field no. SJ-2015).
Coix lacryma-jobi Linn.	Gumma	Horeng (M)	Poaceae	*Seed*	Milky latex	Small herb	To treat glycosuria, administer a paste of seeds (10 g) and old jaggery (5 g) once day for a week (Field no. SJ- 1088).

Ceratophyllum demersum Linn.	Udaygiri	Pani-shiuli (O)	Ceratophyllaceae	Flower herbs without roots	Seed	Submerged herb	For the treatment of glycosuria, the flowers' juice (10 g) is taken each morning for a month together with a tea spoon of lime juice and a pinch of table salt (Field no. SJ-2050).
Cassia occidentalis Linn.	Rayagada	Goru (Kond h)	Caesalpiniaceae	Leaf	seeds	Undershrub	To lower blood sugar levels in 5 days, a leaf decoction (10 ml) is suggested twice day (Field no. SJ-1030).
Cucumis trigonus Roxb.	Kashinagar	Gome (B)	Cucurbitaceae	Root	Dried pulp	Climbing herbs.	The amount of glucose in urine is reduced by about 4-5 g of root powder combined with 8 –10 of curd, taken every day for a week to prevent excessive urination (Field no. SJ- 1905).
Cymbopo gon citratus (DC.) Stapf.	Rayagada	Dhanwantari (O)	Poaceae	Leaf tufted, perennial, scented grass.	Milky latex	Densely tufted, perennial scented herb	To lower blood glucose levels, 10 ml of a leaf decoction is administered once daily for one week (Field no. SJ-7010).
Embelia ribes Burm.f.	Nuagada	Bidanga (O)	Myrsinaceae	Fruit	Bark	Shrub	In case of general weakness brought on by diabetes, mixing fruit powder (2–8 g) with 32 black pepper (*Piper nigrum*) seeds in hot water is advised (Field no. SJ- 2350).
Euphorbia ligularia Roxb. *nerifolia* auct. non Linn.)	Gumma	Siju	Euphorbiaceae	Root	Seed	Miniature tress or succulent shrubs	To lower blood sugar levels, "Guduchi" (*Tin ospora cordifolia*) root juice (5 ml) and stem juice (3 ml) are given each morning for 10 days (Field no. SJ-6010).

Holoptelea integrifolia (Roxb.) Planch	Rayagada	Chilbil (Kharw).	Ulmaceae	Bark or Leaf deciduous tree	Milky latex	Big deciduous tree	It is suggested to take 5 g of the juice from the boiled bark of the 'Nimbah' plant (*Azadirachta indica*) once daily for 2–7 days. Alternately, a cup of lukewarm water can be steeped with either bark or leaves over night and then administered in the morning (Field no. SJ-9050).
Mallotus philippensis (Lam.) Muel-Arg.	Rayagada	Rora	Euphorbiaceae	Fruit	Milky latex	Miniature trees	To reduce the amount of sugar in urine, fruit juice (3 ml) is given once day for four days along with 5 ml of goat milk (Field no. SJ-2610).
Lagenaria siceraria (Molina) Standley (L. *vulgaris* Seer.)	Mohana	Laoo(O)	Cucurbitaceae	Fruit	Dried pulp	Big trailing herbs	To lower blood glucose levels, fruit pulp (5–10 g) is cooked with cow's milk and given every day for three months (Field no. SJ-5120).
Pistia stratiotes Linn. var. cuneata Engl.	Rayagada	Takapana (B)	Araceae	Entire plant	-	Free-floating aquatic stoloniferous herb.	It is recommended to infuse young plants (5ml) with equal amounts of green coconut milk to lower blood glucose levels (Field no. SJ- 1025).
Saraca asoca (Roxb.) de Wilde.	Rayagada	Asoka (O).	Caesalpiniaceae	Flower	Seeds	Small tree	Leachates of flowers along with 5g of old jaggery given with 50 ml cow - milk in the morning for one month is helpful
Wrightia tinctoria (Roxb.) R.Br.	Gumma	Khirna (Kharw	Apocynaceae	Seeds or Bark	Leaves	Miniature deciduous trees	It is recommended to take a decoction of the seeds (10–20 g) or bark powder (2-6 g) once daily for two weeks, especially in acute instances (Field no. SJ-

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Authors contributions

KBS, SJ and SKM conceived the idea. SJ performed the experiments. KBS, SJ and SKM analysed the data. All the authors made significant contributions in drafting the manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues : None.

References

1. Mariam A. Some medicinal plant resources and traditional uses in Pakistan. Journal of Plant Breeding and Crop Science. 2015 May 20;7(5):158-62.
2. Joseph B, Jini D. Insight into the hypoglycaemic effect of traditional Indian herbs used in the treatment of diabetes. Research Journal of Medicinal Plant. 2011;5(4):352-76. https://doi.org/10.3923/rjmp.2011.352.376
3. Saeedi P, Salpea P, Karuranga S, Petersohn I, Malanda B, Gregg EW, Unwin N, Wild SH, Williams R. Mortality attributable to diabetes in 20–79 years old adults, 2019 estimates: Results from the International Diabetes Federation Diabetes Atlas. Diabetes research and clinical practice. 2020 Apr 1;162:108086. https://doi.org/10.1016/j.diabres.2020.108086
4. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, Malanda B. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes research and clinical practice. 2018 Apr 1;138:271-81. https://doi.org/10.1016/j.diabres.2018.02.023
5. Mamdouh M, Shaban S, Ibrahim Abushouk A, Zaki MM, Ahmed OM, Abdel-Daim MM. Adipokines: potential therapeutic targets for vascular dysfunction in type II diabetes mellitus and obesity. Journal of Diabetes Research. 2017 Feb 13;2017. https://doi.org/10.1155/2017/8095926
6. Mateti UV, Nagappa AN, Attur RP, Bairy M, Nagaraju SP, Mallayasamy S, Vilakkathala R, Guddattu V, Balkrishnan R. Preparation, validation and user-testing of pictogram-based patient information leaflets for hemodialysis patients. Saudi Pharmaceutical Journal. 2015 Nov 1;23(6):621-25. https://doi.org/10.1016/j.jsps.2015.01.022
7. Bhojani U, Devedasan N, Mishra A, De Henauw S, Kolsteren P, Criel B. Health system challenges in organizing quality diabetes care for urban poor in South India. PloS one. 2014 Sep 4;9(9):e106522. https://doi.org/10.1371/journal.pone.0106522
8. Satyanaryan T, Chinna Eswaraiah M, Rao N, Hema Latha E, Mathews A. Anti inflammatory activity of dried aerial part of *Parkinsonia aculeata* Indian Journal of Natural Products.
9. Luo J, Fort DM, Carlson TJ, Noamesi BK, niiⵅAmonⵅKotei D, King SR et al. *Cryptolepis sanguinolenta*: an ethnobotanical approach to drug discovery and the isolation of a potentially useful new antihyperglycaemic agent. Diabetic medicine. 1998 May;15(5):367-74. https://doi.org/10.1002/(SICI)1096-9136(199805)15:5%3C367::AID-DIA576%3E3.0.CO;2-G
10. Lather A, Gupta V, Bansal P, Sahu M, Sachdeva K, Ghaiye P. An Ayurvedic polyherbal formulation Kaishore Guggulu: a review. Int J Pharm Biol Arch. 2011;2(1):497-503.
11. Shah VN, Garg SK. Managing diabetes in the digital age. Clinical Diabetes and Endocrinology. 2015 Dec;1(1):1-7. https://doi.org/10.1186/s40842-015-0016-2
12. Berhaut J. Flora of Senegal. Flora of Senegal.. 1967 (2nd ed.).
13. Tuhin RH, Begum M, Rahman M, Karim R, Begum T, Ahmed SU, Mostofa R, Hossain A, Abdel-Daim M, Begum R. Wound healing effect of Euphorbia hirta linn.(Euphorbiaceae) in alloxan induced diabetic rats. BMC complementary and alternative medicine. 2017 Dec;17(1):1-4. https://doi.org/10.1186/s12906-017-1930-x
14. Fajinmi OO, Olarewaju OO, Arthur GD, Naidoo K, Coopoosamy R. Cucurbitaceae species used as traditional medicine in West Africa. Journal of Medicinal Plants for Economic Development. 2022 Nov 29;6(1):9. https://doi.org/10.4102/jomped.v6i1.163
15. Rambey R, Purba Er, Hartanto A, Prakoso BP, Peniwidiyanti P, Irmayanti L, Purba MP. Diversity and ethnobotany of Araceae in Namo Suro Baru Village, North Sumatra, Indonesia. Biodiversitas Journal of Biological Diversity. 2022 Dec 10;23(11). https://doi.org/10.13057/biodiv/d231155
16. Sundaram SS, Suresh K, Sundaram SP. Indigenous knowledge on medicinal plants used to treat various human ailments in Madurai District, Tamil Nadu, India. Journal of Medicinal Plants. 2019;7(3):117-23.