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Survey of some traditionally used anti-diabetic plants in Amboli region of Maharashtra, India in perspective of Ayurveda

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Abstract
Medicinal plants play an important role in improving health and are gaining acceptability worldwide. Various ethnomedicinal studies had been conducted in India to document the medicinal plants used by tribals in various regions. The region Amboli lies in the Sahayadri Hills of Western India and represents dense and diversified vegetation. It is also called as Eco Hotspot of Western Ghats, abound with a variety of unusual flora. The people inhabiting here generally rely on the plants for treatment of diseases for primary health care. So the study was conducted to highlight some more frequently used traditional medicinal plants in Amboli region to treat diabetes. Local healers, traditional practitioners were interviewed in a well structured manner about the plants, its formulations, preparation methods and doses for treating diabetes. Total 18 plants were reported to be used in the treatment of diabetes in Amboli region. Among them *Salacia chinensis, Salacia macrosperma, Casearia esculenta, Alstonia scholaris, Tinospora cordifolia, Gymnema sylvestris, Andrographis paniculata, Curcuma longa* etc. were most frequently used plants. *Ayurveda* classics were referred for identification and proper documentation. Further research is needed to preserve some potent species of folklore plants and to preserve the knowledge of indigenous communities.

Keywords: Diabetes, traditional remedies, ayurveda, Amboli-Western Ghats, India

1. Introduction
In the Universe there exist three sources of *dravya*-minerals, animal products and plant materials [1]. On the basis of easy availability, abundance and economic, plants have been the basic source of therapeutic agents used more frequently by human resources. In spite of regular change in the lifestyles of people, there are a large number of tribal communities / native people, still utilizing the plant genetic resources as medicine occurring in their surrounding vegetation. WHO has estimated that 80% of the world's population relies on traditional medicine for primary health care [2]. There has been increasing interest in recent years in ethno-biological studies mainly because of the renewed interest in traditional medicine. According to a survey conducted by WHO, uses of medicinal plant remedies are on the increase even in developed countries especially among young generation.
Diabetes (*Prameha*) is a chronic metabolic disorder caused by a relative or absolute lack of insulin in the body. Its primary characteristic is a high level of sugar in the body in the fasting or post meal stages [3]. It has been the major problem rising more rapidly in middle and low income countries. WHO projects that diabetes will be the 7th leading cause of death in 2030. At present the International Diabetes Federation estimated that 194 million people live with diabetes worldwide and this number will rise to 333 million in 2025 [4]. It is a complex metabolic disorder posing a huge challenge before the conventional biomedicine in prevention and cure of this disease. Invention of new hypoglycemic agents in the management of diabetes is in continuous process but still efforts are failed to achieve the target goal. Existing treatments such as insulin or other modern pharmaceuticals simply modify the course of diabetic complications due to the multifactorial nature of the disease [5]. So there is need to find out an alternative medicine in the treatment of this disease. Many traditional treatments has been recommended in the complementary and alternative system of medicine for treatment of diabetes [6]. Traditional medicines give a clue to the development of new drug and neutracuticals from the available natural resources. More than 400 plant species having hypoglycemic activities has been reported in the literature up till now [7].

The Western Ghats is one of the 34 biodiversity Hotspots of the world [8]. The region Amboli lies in the Sahayadri Hills of Western India and represents dense and diversified vegetation. It represents the Eco Hotspot of Western Ghats and therefore abounds with variety of unusual flora [9]. The people here are largely dependent on their traditional healing system for their primary healthcare and possess a vast knowledge on the medicinal uses of plants. So this study was undertaken to highlight the traditional use of some medicinal plants in the treatment of diabetes in and around Amboli region of Maharashtra. 18 plants were reported to be used more frequently for the treatment of diabetes mellitus in this region.

2. Material and Methods

2.1 Study site: The place *Amboli* is located in *Sawantwadi Tehsil* in *Sindhudurg* district of Maharashtra, India. It belongs to *Konkan* region and located 421km from state capital Mumbai. Amboli lies in the Sahayadri Hills of Western India, which runs parallel to the western coast of the Indian peninsula, located at an altitude of 690 m, receiving annual rainfall of about 750 centimeter [9, 10]. It lies between 15o57'45"N and 73o59'52''E. Total area of *Amboli* is 5619 hectares. It is the last hill station in south Maharashtra before the coastal highlands of Goa and a relatively unexplored one, represents dense and diversified vegetation comprising large number of trees, climbers, annual or perennial herbs and grasses. It comprises of a large population of tribal communities belonging to various ethnic groups like *Kunbi, Dhangar*, etc. The spoken language here is *Marathi* and *Konkani.* The people inhabiting here rely on the plants for treatment of diabetes for primary health care. They have accumulated enormous knowledge of the treatment through herbs and sustainable use of plant species available to them in their native lands.

3. Methodology

Data was collected from traditional healers known to use medicinal plants to treat diabetes. They were interviewed in a well structured manner about the plants, its formulations, preparation methods and doses for treating diabetes mellitus. Format and data sheets for the documentation of folklore practices were prepared along with the consent letter. Only those supported by atleast 3 references were documented and subjected for taxonomic analysis. Identification of the plants was done by regional taxonomist and flora of Maharashtra [11]. Herbarium\ Photography was done in the field for proper documentation. The *Ayurveda* classics were referred for identification and documentation purpose.

4. Results and Discussion

18 plants were reported to be used more frequently for the treatment of diabetes mellitus in *Amboli*. Table given below shows the documentation of the collected information. Most frequently use plant parts were root, leaf, bark and whole plant. Medicines given were usually of single plant part formulation either in the form of juice, decoction, hot infusion and cold infusion prepared before use. Raw material used was mainly in fresh form or sometimes used in dry form as per availability. Administration was generally before breakfast in the morning or after meal twice daily. Treatment was supposed to be continued till recovery. Data regarding few plants was found to be mentioned in *Ayurveda* literature and recent researches published for anti diabetic study confirming its use trustworthy. Documentation of anti diabetic study of some plant parts is still not validated scientifically and needs further exploration. Plants use in the treatment of diabetes by local people inhabiting this area is provided below with its mode of administration, doses and their references in *Ayurveda* classics.

Table 1: List of medicinal plants traditionally used in treatment of diabetes

Local Name	Sanskrit Name	Botanical Name	Family	Part Used	Traditional Used	Classical reference
Saptarangi	*Saptachakra*	*Salacia chinensis L.*	*Celastraceae*	Root	15ml decoction of root powder taken twice a day after meal.	*Madhumeha* [12]
Saptarangi bheda	*Saptachakra bheda*	*Salacia macrosperma Wight*	*Celastraceae*	Root	15ml decoction of root powder taken twice a day after meal.	*Madhumeha* [12]
Saptarangi substitute	*Saptachakra substitute*	*Casearia esculanta Roxb.*	*Samydaceae; Flacourtiaceae*	Root	15ml decoction of root powder taken twice a day after meal.	*Madhumeha and Pramehapidika* [13]
Kuda	*Kutaja*	*Holarrhena antidysenterica (Linn.)Wall.*	*Apocynaceae*	Root bark	10 ml decoction of root bark powder taken twice a day after meal.	Decoction of bark, leaf, root, fruit or flower of *Kutaja* used in *Prameha* [14], *Mehaghna* [15], *Mehanashaka* [16]
Gulvel	*Guduchi*	*Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thoms.*	*Menispermaceae*	Stem	6-7 cm stem of *Guduchi* is boiled in water. Decoction prepared is taken twice a day in the morning and evening.	*Mehahara* [17], *Pramehahara* [18], *Guduchi juice* with honey indicated in *Prameha* [19, 20], *Prameha* [21], *Mehaghna* [15]
Gudmaar	*Meshashringi*	*Gymnema sylvestris R.Br*	*Asclepiadadeae*	Leaf	3-4 leaves are eaten in the morning half an hour before breakfast. 3-5gm leaf powder is taken with honey in the morning before breakfast.	*Mehanuta* [22], *Mehahara* [23], *Prameha* [24].
Neem	*Nimba*	*Azadirachta indica A. Juss.*	*Meliaceae*	Leaf	4-5 leaves are eaten in the morning half an hour before breakfast.	*Mehanuta* [25], Decoction of bark,

						leaf, root, fruit or flower of *Nimba* used in *Prameha* [14], *Mehaghna* [15], *Prameha* [21].
Kadipatta	*Kaidarya*	*Murraya koenijii (L.) Sprengel*	*Rutaceae*	Leaf	4-5 leaves are eaten in the morning half an hour before breakfast.	-
Kiraita	*Kaalmegh*	*Andrographis paniculata Nees.*	*Acanthaceae*	Whole plant	1 cup decoction prepared from 5gm whole plant powder is taken in the morning before breakfast.	-
Halad	*Haridra*	*Curcuma longa L.*	*Zingiberaceae*	Rhizome	20 ml fresh rhizome juice is taken with 1tsp honey in the morning before breakfast.	*Mehaapaha* [26], *Mehajita* [27], *Mehahanti* [28], *Mehahara* [29], *Pramehahara* [30], *Haridra* powder given with honey and *Amalaki* juice [14, 31, 32].
Pandari Sadaphuli	*Sadampushpa*	*Catharanthus roseus Linn.*	*Apocynaceae*	Leaf	2-3 leaves are chewed in the morning before breakfast	-
Ghaneri	*Chaturaangi, Vanachchhedi*	*Lantana camara L.*	*Verbanaceae*	Leaf	1-2 leaves are chewed in the morning before breakfast	-
Paleasana	*Beejaka*	*Pterocarpus marsupium Roxburgh*	*Fabaceae*	Bark	20 ml decoction of bark is taken twice a day after meal.	*Mehahanti* [33], *Mehahara* [23], *Prameha* [24].
Saatvin	*Saptaparna*	*Alstonia scholaris R.Br*	*Apocynaceae*	Bark	1) *Alstonia scholaris* bark, *Gymnema sylvestris* leaf and *Azadirachta indica* leaf are taken in same proportion and powdered. 3-5 gm powder is taken twice daily in morning before breakfast and evening for a period of 3 months, 6 months or 1 year depending on severity of disease. 2) Powder of *Alstonia scholaris* bark 1kg, *Allium sativum* ½ kg+ *Piper nigrum* ¼ kg is kept prepared. 2 g powder is taken once daily after meal at night time for a period of 3 months.	*Meha* [15], *Saandrameha* [34]
Jaambhala	*Jambu*	*Syzigium cumini (L.) Skeels.*	*Myrtaceae*	Bark, Seed	1) Water is kept overnight in the wooden glass prepared from bark. Water is filtered and taken in the morning before breakfast for 7 days 2) 1gm seed powder is taken twice daily with warm water for 3 months.	Seed in *Madhumeha* [35]
Manjisth	*Manjistha*	*Rubia cordifolia Linn.*	*Rubiaceae*	Root	20 ml root decoction is taken daily in the morning on empty stomach.	Mehanuta [36] Manjisthameha [34]
Upalsari	*Sariva*	*Hemidesmus indicus R.Br.*	*Asclepiadaceae*	Root	The root hot infusion is taken twice a day for a period of six weeks.	Mehanashaka [37].
Avala	*Amalaki*	*Phyllanthus emblica L.*	*Euphorbiaceae*	Fruit	Recommended as a food for diabetic patients.	Pramehaghna [38], Prameha [29].

It was found that *Celastraceae* family tops the list followed by *Apocynaceae* and *Asclepiadaceae.* Classical reference of *Saptachakra* was found in *Madhumeha (Diabetes mellitus).* Plants *Kutaja, Guduchi, Meshashringi, Nimba, Beejaka, Saptaparna, Jambu, Manjistha, Sariva and Amalaki* were mentioned as *Mehanut, Mehaghna, Mehanashaka, Pramehaghna, Pramehahara in classics* indicating its broad term use in all types of diabetes. Classical reference of few plants like *Kaidarya, Kaalmegh, Sadapushpa* and *Chaturaangi was not given in diabetes. Sushruta* had recommended *Saptaparna* decoction specifically in *Sandramehi* (Phosphaturia) whereas *Manjistha* decoction in *Manjisthamehi* (Haemoglobinuria) for the first time. After statistical analysis it was found that 60% cases follows modern interventions along with herbal remedies whereas 40% were found to depend totally on herbal remedies.

5. Conclusion

This was a short study conducted to document the plants used here for the treatment of Diabetes. Data available regarding the anti-diabetic study of documented plants will help to adequately evaluate or recommend their use. Clinical intervention researches are required to provide an evidence based criteria for a safe and effective use of the identified plants. Also efforts should be taken to preserve some folklore species. Thus the above study can prove beneficial in new drug development and development of nutraceuticals from the natural resourses.

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