



## TRADITIONAL HERBAL MEDICINES IN PREVENTION AND TREATMENT OF CARDIOVASCULAR DISEASES IN ODISHA

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Millenary civilizations rely on plants for medicinal purposes in simple forms like decoctions, powders, and ointment and continue even nowadays. Plant based products have always been exploited to promote human health and served as a valuable source for the discovery of new drugs. The knowledge of traditional healthcare system differs from place to place and should have to be documented. My study aims to explore the utilization of plants in cardiovascular disease by the people of Bhadrak District, Odisha, India. In the present study, information on use of plants for cardiovascular diseases was collected from 89 informants using semi-structured interviews, key informant discussions and direct observations. A total of 41 plant species under 28 families have been used for the treatment of cardiovascular diseases of which Asteraceae, Fabaceae and Zingiberaceae are the most frequent. The frequently cited species used to treat such ailments are *Allium sativum* L., *Curcuma longa* L., *Linum usitatissimum* L., *Ocimum sanctum* L., *Phyllanthus emblica* L., *Rauwolfia serpentina* (L.) Benth.ex Kurz., *Terminalia arjuna* (Roxb.ex DC.) Wight & Arn., *Tamarindus indica* L. and *Zingiber officinale* Rosc. The leaves are the most commonly used plant part and decoction was the main method of preparation. Herbs (41.5%) and trees (39%) are equally dominant. The present information suggests that the reported medicinal plants can be rich sources for developing new and effective pharmaceuticals for the treatment of cardiovascular diseases. However, clinical studies of the all the medicinal plants are required for the benefit of posterity.

**Keywords:** Ayurveda, Bhadrak district, CVDs, Ethnomedicinal plants, Phytomedicine, Traditional knowledge

### Introduction

Through the millenary civilizations, humans have tuned with nature for their primary requirements for the production of food, shelter, clothing, and, most importantly the medicines known as phytomedicine or phytotherapy. The herbal therapy also known as ecological healing is thriving worldwide thousands of years because it works within the context of humanity's shared ecological and traditional knowledge inherited from their ancestors. Herbal medicine is still used by millions of people all over the world<sup>1</sup> because they are free from side effects, safe and less costly. In

present day, cardiovascular diseases have become a major health challenge with an ever-increasing prevalence worldwide due to the change in lifestyle like lack of physical activity, excessive weight, consumption of alcohol, chewing/smoking of tobacco, and inappropriate diet<sup>2</sup>. Cardiovascular diseases (CVD) are spectrum of diseases including coronary artery disease, angina, atherosclerosis, coronary heart disease (heart attacks), cerebrovascular disease (stroke), peripheral vascular disease, cardiac hypertrophy, myocardial infarction, congestive heart failure, and hypertension raised blood pressure<sup>3, 4</sup>. Cardiovascular

disease kills 17.9 million people every year, accounts for 31% of all global deaths<sup>2</sup>. Recent reports indicate that they affect over 23.6 million of the world population by 2030<sup>5</sup>, with the highest burden in low and middle income countries that have minimal medical resources<sup>6</sup>. Consequently, in recent years there has been major enforcement on CVD prevention<sup>7</sup>. Therefore, considering the continued burden from CVDs, new treatment options are now necessary for all types of CVDs. The medicinal plants are potential sources of drugs as they are rich in diverse secondary metabolites and essential oils of therapeutic importance<sup>8, 9</sup>. Accumulation of phytochemical, biological, and clinical data during past decade of 20th century revealed that plant-based herbal remedies are the emerging choice for the treatment of various ailments. Evidently, plant is incredibly an imperative resource for discovery of new drugs, examples include aspirin, digoxin, ephedrine, lovastatin, taxol and reserpine isolated from *Salix alba*, *Digitalis purpurea*, *Ephedra sinica*, *Monascus purpureus*, *Taxus brevifolia*, *Rauwolfia serpentina* respectively and many others<sup>10,11</sup>. Interestingly, reserpine is still an effective treatment for hypertension<sup>12</sup>. Notably, the discovery of antimalarial drugs, quinine from the bark of *Cinchona* species and artemisinin from *Artemisia annua* L., represent a typical example of how traditional medicine can guide drug discovery<sup>11</sup>. The historical records on natural origin of drugs can be traced from Mesopotamia (2600 BCE), which describe the utilization of about 1000 plant-derived compounds. The Egyptians' Ebers Papyrus (1500 BCE) documents more than 700 plant based drugs. Fifty two natural medicinal preparations are recorded from Chinese Materia Medica (BCE 1100). The Indian Ayurvedic record (BCE 1000) documents more than 800 natural medicinal extracts<sup>9,11</sup>. Hippocrates also applied phytotherapy, or

healing with herbs, in his treatments<sup>9</sup>. CVD mortality among the South Asian population (369/100 000) was higher than the global average (286/100 000) in 2015<sup>13</sup>. In Indian scenario, CVD accounts for 28% of the deaths with heart disease being the leading cause<sup>14</sup>. A large proportion of the Indian population for their cardiovascular disease treatment depends on traditional system of medicine as evidenced by published literatures<sup>15-18</sup> but none has paid heed on this aspect in Odisha while there is absolutely no report from the Bhadrak district. The current study is designed to document the traditional uses of plants in the Bhadrak district of Odisha which can play an important role in the development of new, effective drugs as alternative and complementary therapies for better management of CVD.

## Materials and Methods

### Study Site

Bhadrak district is situated between 20° 43'–21° 13'N and 86° 6'–87° E in northeast Odisha and covers 2505 km<sup>2</sup>, with a population of 1.507 million (2011 Census). Four other districts namely Balasore, Kendrapara, Jajpur, and Koenjher surround Bhadrak district while a part is bounded by the Bay of Bengal. The district covers about 1.61 % of the total land area of the state and contributes 3.59 % of the state's population. The climate of the district is warm and humid. The maximum and minimum temperatures range from 37.4°C to 17.7°C, respectively, and the annual average rainfall is approximately 1428mm. About 86.66 % of the inhabitants are villagers and the people are engaged in agricultural practices as their primary occupation. Being situated in close proximity to the Bay of Bengal, the district is characterized by periodic earth tremors, thunderstorms, and dust storms in April and May<sup>19</sup>. Very recently, Panda et al. (2020)<sup>20</sup> compiled 383 species from the district of which about 50% plant species are used for the primary health care by the local people.

### Data collection

The method employed was designed with a purpose of providing base line information on the ethnomedicinal plants used for cardiovascular diseases, through literature survey and field visits to seven blocks of the district i.e. Bhadrak, Bhandaripokhari, Bonth, Dhamnagar, Tihidi, Chandbali and Basudevpur. The sampling sites were visited monthly during the year of 2019 and 2020 following established and standard procedures<sup>21</sup>. The data on medicinal uses of plants were recorded through semi-structured interviews, key informant discussions and direct observations<sup>21, 22</sup>. A total of 89 respondents' (61 males and 28 females) was considered the key informants in the study and the selection process was based on the knowledge and experience in the traditional use of plants for cardiovascular disease treatment. The interviews and discussions were carried out individually with members of the local population in the local language for each of the villages visited. During repeated visits to the study site further group discussions (5-8 people) were held with: i) old-age key informants and ii) with women. Personal interviews and group discussions with local inhabitants revealed some valuable and specific information about the traditional use of plants to treat cardiovascular disease. During the visits, information on plant parts used, modes of preparation and administration and vernacular name if any was collected. Plants were identified following Saxena and Brahmam (1996)<sup>23</sup>.

### Results and Discussion

The medicinal plants are potential sources of drugs as they are rich in secondary metabolites and essential oils of therapeutic importance<sup>24</sup>. The knowledge of the plants used in the treatment of cardiovascular disease is at the level of the elderly. Indeed, in Bhadrak district as elsewhere<sup>25, 26</sup>, indigenous knowledge is often held by elder

or wise people. Thus, properties of medicinal plants are ancestral knowledge that is only transmitted from one generation to another<sup>24, 27</sup>. The present ethnobotanical survey recorded a total of 41 medicinal plants belonging to 28 families that were acquired from 89 informants for the treatment of cardiovascular diseases from different localities of Bhadrak district (Table 1; Fig.1). According to the habit diversity of recorded medicinal plant, 41.5% was herb, 39% was tree, 12.2% was shrub and 7.3% was climber. Fruits, seeds and leaves were the most commonly used part for medicinal plants contributing 63% for the preparation of traditional medicine. Medicinal plant from the families were found high number of species belong to Fabaceae, Asteraceae and Zingiberaceae. The most cited species used to treat such ailments were *Allium sativum* L., *Curcuma longa* L., *Linum usitatissimum* L., *Ocimum sanctum* L., *Phyllanthus emblica* L., *Rauwolfia serpentina* (L.) Benth. ex Kurz., *Terminalia arjuna* (Roxb.ex DC.) Wight & Arn., *Tamarindus indica* L. and *Zingiber officinale* Rosc. Medicinal herbs that were addressed in this article are effective in some way on the treatment and prevention of cardiovascular diseases. For instance, in the present study, the herb *Allium sativum* L. (Garlic) was used as a cardioprotective. Garlic is used in CVDs management and is quite known for its multifaceted properties against CVD-associated conditions such as hypertension, oxidative stress, inflammation, and hyperlipidemia<sup>28-30</sup>. Indeed, by reducing total cholesterol and LDL levels, decreasing the content of lipid in arterial cells and inhibiting vascular smooth muscle cell proliferation, garlic can be used to manage atherosclerosis and hyperlipidemia<sup>31</sup>. Similarly, several investigators have provided evidence suggesting the protective effects of curcumin (the main constituent of the *Curcuma longa* L.) against

Sl. No.	Botanical name & Family	Local name	Parts used	Mode of use
1	<i>Allium sativum</i> L. (Amaryllidaceae)	Rasuna	Seed	Fried and raw seeds is used for cardiovascular disease.
2	<i>Ananas comosus</i> (L.) Merr. (Bromeliaceae)	Sapuri	Fruit	Fruit juice is effective for cardiovascular diseases.
3	<i>Artocarpus lacucha</i> Buch.-Ham. (Moraceae)	Jeutha	Fruit	The fruit powder is used for atherosclerosis.
4	<i>Asparagus racemosus</i> Willd. (Asparagaceae)	Satabari	Tuber	Powder of tuber is used for coronary artery disease and atherosclerosis.
5	<i>Azadirachta indica</i> A. Juss. (Meliaceae)	Neem	Leaf	Decoction of leaf is used for coronary artery disease.
6	<i>Bacopa monnieri</i> (L.) Pennell. (Scrophulariaceae)	Brahmi	Aerial part	Decoction of aerial part is used for myocardial contraction and in coronary blood flow.
7	<i>Benincasa hispida</i> (Thunb.) Cogn. (Cucurbitaceae)	Panikakharu	Fruit	Fruit pulp is used for coronary heart diseases and hypertension.
8	<i>Bombax ceiba</i> L. (Malvaceae)	Simili	Flower	Powdered flower is used for heart disease.
9	<i>Cinnamomum tamala</i> Nees & Eberm (Lauraceae)	Tejpatra	Leaf	Decoction of leaf is effective for cardiovascular diseases.
10	<i>Cinnamomum zeylanicum</i> Bl. Bijdr. (Lauraceae)	Dalchin	Stem bark	Bark powder is used for cardiovascular disorders including high blood pressure.
11	<i>Citrus medica</i> L. (Rutaceae)	Lembu	Fruit	Dried fruit powder is used for myocardial contraction.
12	<i>Coriandrum sativum</i> L. (Apiaceae)	Dhania	Seed	Seed powder is effective for cardiovascular diseases.
13	<i>Cocos nucifera</i> L. (Arecaceae)	Nadia	Coconut water	Coconut water is used for hypertension.
14	<i>Curcuma longa</i> L. (Zingiberaceae)	Haldi	Rhizome	Dried rhizome powder is used for atherosclerosis, vascular dysfunction, cardiac hypertrophy and heart failure.
15	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Duba	Rhizome,	Rhizome is used for the treatment of heart failure.
16	<i>Cyperus rotundus</i> L. (Cyperaceae)	Mutha ghas	Rhizome	Rhizome powder is used for hypertension.
17	<i>Eclipta prostrata</i> (L.)L. (Asteraceae)	Bhrungaraj	Leaf	Decoction of leaf is used for hypertension and atherosclerosis.
18	<i>Elettaria cardamomum</i> (L.) Maton (Zingiberaceae)	Gujurati	Fruit	Fruit powder is used against high blood pressure and heart disease.
19	<i>Enhydra fluctuans</i> Lour. (Asteraceae)	Hidimicha	Leaf	Decoction of Leaf ( <i>Enhydra fluctuans</i> ) mixed with equal amount of <i>Centella asiatica</i> and cucumber juice is used for hypertension.
20	<i>Helianthus annuus</i> L. (Asteraceae)	Suryamukhi	Seed oil	Seed oil is used for hypertension.
21	<i>Hibiscus sabdariffa</i> L. (Malvaceae)	Khatabhendi	Flower	Decoction of flower is used for hypertension and hyperlipidemia.
22	<i>Ipomea aquatica</i> Forssk. (Convolvulaceae)	Kalama	Leaf	Fried leaf is used for hypertension.
23	<i>Linum usitatissimum</i> L. (Linaceae)	Pesu	Seed	Seed oil is used for atherosclerosis.
24	<i>Morus alba</i> L. (Moraceae)	Tutkuli	Leaf	Leaf powder is used for hypertension.

25	<i>Nelumbo nucifera</i> Gaertn. (Nelumbonaceae)	Padma	Seed	Seed powder is used for heart complaints.
26	<i>Ocimum basilicum</i> L. (Lamiaceae)	Kapurkanti	Leaf	Decoction of aerial part is used to treat hypertension and cardiovascular disease complications.
27	<i>Ocimum sanctum</i> L. (Lamiaceae)	Tulsi	Leaf	Decoction of leaf is used for ischemia, stroke and hypertension.
28	<i>Phyllanthus emblica</i> L. (Phyllanthaceae)	Amla	Fruit	Dried fruit is used for cardiovascular disorders.
29	<i>Pistacia vera</i> L. (Anacardiaceae)	Pista	Nut	Nuts are used for hypertension and coronary heart disease.
30	<i>Punica granatum</i> L. (Lythraceae)	Dalimba	Fruit	Fruit juice is used for ischemic heart disease and hypertension.
31	<i>Rauvolfia serpentina</i> (L.) Benth.ex Kurz. (Apocynaceae)	Patalgaruda	Root	Root paste is given to reduce blood pressure.
32	<i>Rauvolfia tetraphylla</i> L. (Apocynaceae)		Root	Dried root powder is taken to control blood pressure.
33	<i>Santalum album</i> L. (Santalaceae)	Chandan	Heart wood	Heart wood powder is used for heart diseases.
34	<i>Sesbania grandiflora</i> L. Pers (Fabaceae)	Agasti	Leaf	Powdered leaf is used for heart disease.
35	<i>Tamarindus indica</i> L. (Fabaceae)	Tentuli	Seed, fruit pulp	Extract of seeds and small pieces of the fruit pulp is used for myocardial function.
36	<i>Tephrosia purpurea</i> (L.) Pers. (Fabaceae)	Banakulathi	Whole plant	Decoction of whole plant extract is used for cardiac complications.
37	<i>Terminalia arjuna</i> (Roxb.ex DC.) Wight & Arn. (Combretaceae)	Arjuna	Stem bark	Bark powder is useful for heart diseases.
38	<i>Terminalia chebula</i> Retz. (Combretaceae)	Harida	Fruit	Fruit powder is used for heart diseases.
39	<i>Vigna radiata</i> (L.) Wilczek. (Fabaceae)	Mungo	Seed	The germinating seed is used for cardiovascular diseases.
40	<i>Withania somnifera</i> (L.) Dunal. (Solanaceae)	Ashwagandha	Root	The root powder is used to treat hypertension.
41	<i>Zingiber officinale</i> Rosc. (Zingiberaceae)	Ada	Rhizome	The fresh rhizome juice is used for heart diseases.

**Table 1.** Ethnobotanical inventory of medicinal plants used for cardiovascular disorder in Bhadrak district, Odisha, India

cardiovascular pathologies, such as atherosclerosis, vascular dysfunction, cardiac hypertrophy and heart failure<sup>32, 33</sup>. Among other medicinal plants *Hibiscus sabdariffa*, is known to reduce BP using its ability to inhibit angiotensin-converting enzyme<sup>34</sup>. In the present investigation decoction of *Ocimum sanctum* L. leaf was used for ischemia, stroke and hypertension.

Perception of the local people in the studied area indicates that regular consumption of Tulsi leaves not only promotes health but also provides longevity. Studies in rat models have shown that consumption of fresh Tulsi leaves increases cardiac endogenous antioxidants and hinders myocardial necrosis<sup>35-37</sup>.



**Figure 1.** a. *Asparagus racemosus* Willd. b. *Azadirachta indica* A. Juss. c. *Bacopa monnieri* (L.) Pennell. d. *Benincasa hispida* (Thunb.) Cogn. e. *Bombax ceiba* L. f. *Cinnamomum tamala* Nees & Eberm. g. *Eclipta prostrata* (L.)L. h. *Eleteria cardamomum* (L.) Maton i. *Hibiscus sabdariffa* L. j. *Linum usitatissimum* L. k. *Morus alba* L. l. *Nelumbo nucifera* Gaertn. m. *Ocimum basilicum* L. n. *Ocimum sanctum* L. o. *Phyllanthus emblica* L. p. *Punica granatum* L. q. *Rauwolfia tetraphylla* L. r. *Santalum album* L. s. *Sesbania grandiflora* L. Pers. t. *Terminalia arjuna* (Roxb.ex DC.) Wight & Arn.

While studying the antihypertensive effects of *Ocimum sanctum*, Borhanuddin (2016)<sup>38</sup> stated that treatment with *Ocimum sanctum* in rat reduced the pressure by 66/50mm of Hg with 1mg dose which is highly significant in comparison to normal (83/71 mm of Hg). Similarly, *Phyllanthus emblica* L. is a rich source of vitamin C, which plays an important role in scavenging free radicals, thus attenuates stress induced cardiovascular changes through its antioxidant action<sup>39</sup>. *P. emblica* has been reported to reduce arterial BP and heart rate (HR) in rats with deoxycorticosterone acetate/1% sodium chloride high salt-induced hypertension<sup>40</sup>. *Rauvolfia serpentina* (L.) Benth.ex Kurz. holds an important position in the pharmaceutical world due to the presence of various alkaloids in the root. Alkaloids of this plant have a great medicinal importance to treat cardiovascular diseases, high blood pressure, hypertension, and arrhythmia<sup>41-43</sup>. The Indian physician Vakil is considered responsible for introducing *Rauvolfia* to Western medicine<sup>44</sup>. In 1949, Vakil<sup>44</sup> reported on a study of 50 patients with essential hypertension who were treated with *Rauvolfia*. In that study, 85% of patients experienced a drop in systolic blood pressure, and 81% of patients experienced a drop in diastolic blood pressure. Medicinal usage of bark of *Terminalia arjuna* (Roxb.ex DC.) Wight & Arn. for cardiac treatment has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani<sup>45</sup>. The existing experimental evidences suggest the bark extract of *T. arjuna* induce myocardial ischemia, hypertrophy, fibrosis, anti-hypotensive effects and other cardiovascular disorders<sup>46, 47</sup>. Ginger (*Zingiber officinale*) has been used to treat cardiovascular diseases for a long time, and it is known to exert diuretic and blood pressure-lowering

functions<sup>48, 49</sup>. Experimental evidence on biochemical role of ginger extract in myocardial damage and protective effect on atherosclerosis has been reported<sup>50-52</sup>. Similarly, several lines of evidence point to *Bacopa monnieri* (L.) Pennell, *Bombax ceiba* L., *Coriandrum sativum* (L.), *Elettaria cardamomum* (L.) Maton, *Helianthus annuus* L. *Ipomea aquatica* Forssk., *Linum usitatissimum* L., *Punica granatum* L., *Sesbania grandiflora* L. pers and *Tamarindus indica* L. having potentially improve cardiovascular function<sup>53-62</sup>. Current investigation recorded a higher frequency of herbs for medicinal use which corroborates the findings of Aziz et al. (2018)<sup>63</sup> and Akash and Zakir (2020)<sup>64</sup>. In the present investigation leaves were the most commonly used part (24%) for the preparation of traditional medicine. Similar trend of using leaves for medicinal use has also been reported from other studies<sup>64-66</sup>. Decoction was the most common preparation method used by the people in the studied area. The similar results are observed by Kinda et al. (2017)<sup>67</sup>, Lawin et al. (2015)<sup>68</sup> and Alfa et al. (2018)<sup>69</sup>.

### Conclusion

Substantial evidence of the therapeutic values of the reported plants in the present findings can ameliorate conditions associated with CVDs. Moreover, lifestyle changes, including diet, exercise, and stress management, may contribute significantly to lowering of CVD. We conclude that better-designed pharmacological and toxicological studies and future clinical trials are needed to investigate the role of different medicinal plants and their underlying mechanisms in the context of CVDs.

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