

ORIGINAL ARTICLE

A Randomized Survey of Medicinal plants used by Folk Medicinal Practitioners in Daudkandi sub-district of Comilla district, Bangladesh

¹Mohammed Rahmatullah, Md. Abdul Momen, Md. Mahbubur Rahman, Dilruba Nasrin, Md. Shahadat Hossain, Zubaida Khatun, Farhana Israt Jahan, ²Mst. Afsana Khatun, Rownak Jahan

¹Faculty of Life Sciences, University of Development Alternative, Dhanmondi, Dhaka, Bangladesh.

²Dept. of Pharmacy, Lincoln College, Mayang Plaza, Block A, No 1, Jalan SS 26/2, Taman Mayang Jaya, 47301, Petaling Jaya, Selangor Darul Ehsan, Kuala Lumpur, Malaysia.

Mohammed Rahmatullah, Md. Abdul Momen, Md. Mahbubur Rahman, Dilruba Nasrin, Md. Shahadat Hossain, Zubaida Khatun, Farhana Israt Jahan, Mst. Afsana Khatun, Rownak Jahan: A Randomized Survey of Medicinal plants used by Folk Medicinal Practitioners in Daudkandi sub-district of Comilla district, Bangladesh: *Adv. in Nat. Appl. Sci., C(C): CC-CC, 2010.*

ABSTRACT

Folk medicinal practitioners (Kavirajes) are possibly the most ancient practitioners of traditional medicine in Bangladesh and in general are the primary health-care providers to a majority of the rural population and a substantial segment of the urban population in the country. The major characteristic that separates the folk medicinal practitioners from other systems of existing medicinal practices is their almost exclusive use of simple preparations of medicinal plants for treatment of various ailments. Since the population of Bangladesh is primarily rural, village Kavirajes form the major unit from whom ethnomedicinal data can be obtained. The objective of the present study was to conduct a randomized ethnomedicinal survey among the Kavirajes of four villages, Kalakandi, Gorashal, Kadamtoli, and Gunjar, all villages being situated in Daudkandi sub-district of Comilla district in Bangladesh. Informed consent was obtained from the Kavirajes and surveys were carried out with the help of a semi-structured questionnaire and the guided field-walk method, where the Kavirajes took the interviewers to places from where they collected their medicinal plants, pointed out the plants and described their uses. All plant specimens were collected and identified at the Bangladesh National Herbarium. It was observed that the Kavirajes of the four villages surveyed used 44 plant species distributed into 32 families. The Lamiaceae family contributed 4 plants, followed by the Leguminosae, Rutaceae, and Solanaceae families with 3 plants each. Leaves constituted the major plant part used (45.3%), followed by roots (13.2%), and whole plants, fruits, and seeds (7.5% each). The various ailments treated included respiratory tract problems, gastrointestinal disorders, sexual problems, fever, cardiovascular disorders, mental disease, diabetes, loss of hair, vomiting, menstrual problems, skin disorders, hepatic disorders, piles, leprosy, calcium deficiency, dental diseases, cracked foot, bleeding, insect bites, mumps, rabies, chicken pox, body ache, and bone fracture. Cumulatively, the plants obtained in the present survey present considerable potential for further scientific research towards discovery of lead compounds and more efficacious drugs.

Key words: Folk medicine, medicinal plants, Daudkandi, Comilla, Bangladesh

Introduction

Traditional medicine in various cultures approaches cure of diseases from a holistic view point where the human being and the ailments that he is suffering from is dynamically related to his culture, biota, and the environment. Instead of a simple patient-disease-medicine concept, the traditional healer takes a number of

Corresponding Author: Dr. Mohammed Rahmatullah, Pro-Vice Chancellor University of Development Alternative House No. 78, Road No. 11A (new) Dhanmondi R/A, Dhaka-1205 Bangladesh
Fax: 88-02-8157339
Email: rahamatm@hotmail.com

factors into account including the patient's cultural beliefs, his ancestry, and various inter-related socioeconomic and psychological factors, which may have contributed to the disease process. As such, treatment can be simple or often complicated. Folk medicinal healers are a group of traditional medicinal healers who usually rely on simple procedures for treatment of diverse ailments. The major weapon of folk medicinal healers of Bangladesh, otherwise known as Kavirajes, is use of medicinal plants for treatment of diseases. A single plant or plant part or a combination of plants or plant parts are used in the form of decoctions, paste, or pills and administered to the patient orally or topically depending on the disease. The proficiency that a Kaviraj attains during his practice is obtained from a member of the immediate family from an earlier generation, is supplemented with knowledge that the Kaviraj gains from his practice, and is passed to an immediate member of the next generation or to a trusted disciple. With time, the medicinal plants used by Kavirajes become highly divergent and can vary immensely between Kavirajes of even adjacent areas.

Our ethnomedicinal surveys carried out amongst different tribes and in various regions of the country strongly point to such divergent uses of medicinal plants by the Kavirajes (Rahmatullah *et al.*, 2010; Hossan *et al.*, 2010; Nawaz *et al.*, 2009; Rahmatullah *et al.*, 2009; Rahmatullah *et al.*, 2009; Mia *et al.*, 2009). Since Bangladesh has over 86,000 villages, with nearly each village containing one or more Kavirajes (depending on the village population), it is important to survey as many villages as possible to get a comprehensive view of medicinal plant usage by the Kavirajes. It was the objective of the present study to conduct a randomized ethnomedicinal survey among the Kavirajes of four villages, namely, Kalakandi, Gorashal, Kadamtoli, and Gunjar in Daudkandi sub-district of Comilla district, Bangladesh.

Materials and Methods

Daudkandi sub-district is a part of Comilla district, which falls in the central part of Bangladesh. The main occupation of the people of this sub-district is agriculture. However, to a certain extent the area is also noted for its local handicrafts. The present survey was conducted in the villages of Kalakandi, Gorashal, Kadamtoli, and Gunjar in the sub-district.

A total of 4 Kavirajes were interviewed for the present survey, one from each village. The Kavirajes were Md. Salam Sarker, Md. Jiauddin Mollah, Haji Md. Shirajuddin Sarker, and Md. Fatik Sen. It is to be noted that each Kaviraj was the only practicing Kaviraj in his village. Informed consent was obtained from the Kavirajes prior to the survey. The Kavirajes were told that the results may be disseminated both nationally and internationally, to which they had no objections. Interviews were conducted in the Bangla language (spoken by both Kavirajes and interviewers) with the help of a semi-structured questionnaire and the guided field-walk method as described by Martin (Martin, 1995) and Maundu (1995). In this method, the Kavirajes took the interviewers to places from where they collected their medicinal plants, pointed out the plants, gave their local names and described their uses. All information was cross-checked with the Kavirajes in later sessions. Plant specimens were collected, dried in the field, and brought back to Bangladesh National Herbarium at Dhaka for complete identification.

Results and Discussion

A total of 44 plant species distributed into 32 families were found to be used by the Kavirajes for treatment of various ailments. The results are summarized in Table 1. The Lamiaceae family contributed the highest number of plant species (4), followed by the Leguminosae, Rutaceae and Solanaceae families with 3 plants per family.

Virtually all parts of the plant were used by the Kavirajes. These included whole plants, leaves, stems, barks, roots, flowers, fruits, seeds, gum, and rhizomes. Leaves constituted the major plant part used (45.3%), followed by roots (13.2%). The results are shown in Table 2. The mode of preparation of plants or plant parts for oral or topical administration was juice (extracted through crushing of the plant, e.g. *Justicia adhatoda* L.), powder of dried plant or plant parts (e.g. flowers of *Calotropis gigantea* (L.) R.Br.), paste (e.g. *Bombax ceiba* L.) boiled plant or plant part (e.g. *Coccinia grandis* (L.) Voigt.), tablets (e.g. *Leucas aspera* (Willd.) Link). Occasionally, a plant part may be directly consumed (e.g. seeds of *Mimusops elengi* L.).

It was noted that a plant or plant part may be administered in combination with other substances. For example, juice obtained from leaves of *Justicia adhatoda* was orally administered with honey for treatment of coughs. Juice obtained from crushed leaves of *Terminalia arjuna* (Roxb.) Wight & Arn. was taken with sugar for treatment of heart diseases. Root juice of *Coccinia grandis* was mixed with coconut oil and applied to the head for mental diseases. Juice obtained from crushed leaves of *Dalbergia sissoo* Roxb. ex DC. was administered with hot saltwater for treatment of menstrual problems.

In almost all cases, a single plant was used for treatment of ailments, which could be single or multiple. There was one instance of two plant parts used in combination. For treatment of jaundice, the leaves of *Glycosmis pentaphylla* Retz. were used in combination with mango (*Mangifera indica* L.) bark. Different plant parts from the same plant were sometimes used for treatment of different ailments. To cite one example, the leaves and roots of *Calotropis gigantea* were used as remedy for coughs while the flowers from the same plant were used as remedy for dysentery. A combination of two plant parts of the same plant also was occasionally used for treatment of a single ailment. The leaves and roots of *Bombax ceiba* were taken in combination to increase sexual activity (i.e. in cases of loss of libido).

Table 1: Medicinal plants used by the Kavirajes of Daudkandi sub-district, Comilla district, Bangladesh

Sl. No.	Botanical name	Family	Local name	Part(s) used	Ailment
1	<i>Justicia adhatoda</i> L.	Acanthaceae	Bashok	Leaves	Cough. 100g of juice obtained from leaves is
2	<i>Calotropis gigantea</i> (L.) R.Br.	Asclepiadaceae	Akondo	Leaves, roots, flowers	taken orally with honey (1 tea-cup twice daily for 5 days). Coughs, dysentery. 1. 50g juice collected from crushed leaves and roots is taken twice daily for 3 days as remedy for coughs. 2. 2g powder of dried flower is mixed with
1					tablespoonful of water and taken once daily
3	<i>Bombax ceiba</i> L.	Bombacaceae	Shimul	Leaves, roots	3 days as remedy for dysentery. To increase sexual activity. 50g paste of young leaves and roots is taken orally twice a day for 15 days.
4	<i>Carica papaya</i> L.	Caricaceae	Pepe	Fruits	Fever, blood dysentery. 200g fruit juice is taken twice daily for 5 days.
5	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn	Combretaceae	Arjun	Barks	Sex stimulant, heart disease. 50g juice obtained from crushed leaves is taken with 20g sugar and taken twice daily
for					heart diseases.
6	<i>Terminalia chebula</i> (Gaertn.) Retz.	Combretaceae	Hortoki	Fruits without seeds	Purgative, cough relief. 1. 100g juice of unripe fruits is taken for 7 days as purgative. 2. 100g juice of ripe fruits is taken for 5 days as remedy for coughs.
7	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Pathor-kuchi	Leaves	Gastric problems. 50g of juice collected from leaves is mixed with a small amount of honey and taken twice daily for 7 days.
8	<i>Coccinia grandis</i> (L.) Voigt.	Cucurbitaceae	Kalakuch	Roots,	Mental disease, diabetes. whole plant 10g of root juice is mixed with 50g coconut oil and the mixture applied to the head twice daily for 1 year (remedy for mental disease). 50g of whole plant is boiled and taken as a vegetable with rice thrice daily for 6 months (remedy for diabetes).
9	<i>Dillenia indica</i> L.	Dilleniaceae	Chalta	Leaves	Sex stimulant. 25g juice obtained from crushed leaves is taken once daily for 15 days.
10	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Amloki	Leaves	Loss of hair, to stop vomiting. 50g juice obtained from crushed leaves is mixed with 20g sugar and taken twice daily for 2 weeks.
11	<i>Phyllanthus reticulatus</i> Poir.	Euphorbiaceae	Chiptin	Leaves, roots	Dysentery. 100g of juice collected from leaves and roots is taken once daily for 15 days.
12	<i>Leucas aspera</i> (Willd.) Link	Lamiaceae	Dol kolosh	Leaves, flowers	Peptic ulcer, stomach ache. 50g leaves and 20g flowers are grinded to make 14 tablets. One tablet is taken daily for 30 days.
13	<i>Mentha spicata</i> L.	Lamiaceae	Pudina pata	Leaves	To stop vomiting. 50g juice of leaves is taken with 10g water.
14	<i>Ocimum gratissimum</i> L.	Lamiaceae	Kalo tulshi	Leaves	Coughs, fever. Juice obtained from 20g leaves is taken with sugar twice daily (1-2 cups).
15	<i>Ocimum sanctum</i> L.	Lamiaceae	Shada tulshi	Leaves	Coughs. 50g of juice obtained from crushed leaves is mixed with 20g sugar and taken twice daily for 3 days.
16	<i>Cinnamomum tamala</i> (Ham.) Nees & Eberm.	Lauraceae	Tejpata	Leaves	For strong teeth. 20g paste of leaves is chewed daily with common salt.

Table 1: Continue

17	<i>Dalbergia sissoo</i> Roxb. ex. DC.	Leguminosae	Shishu	Leaves	Menstrual problems. 50g juice obtained from crushed leaves is taken with hot saltwater twice daily.
18	<i>Dolichos lablab</i> L.	Leguminosae	Shim	Leaves	Tinea infection. 20g juice collected from leaves is applied twice daily to the affected areas for 4 days.
19	<i>Mimosa pudica</i> L.	Leguminosae	Lajjaboti	Roots	Jaundice. 50g of root paste is taken with cumin orally twice daily for 30 days.
20	<i>Aloe vera</i> L.	Liliaceae	Ghrita-kumari	Leaves	Purgative, piles. 100g leaf juice (1 tea cup) is taken with sugar twice daily for 14 days.
21	<i>Lawsonia inermis</i> L.	Lythraceae	Mehedi	Leaves	Hair loss, leprosy. 50g of leaf juice is applied to hair once daily prior bathing to control hair loss. 100g of leaf paste is applied to the affected place twice daily as remedy for leprosy.
22	<i>Punica granatum</i> L.	Lythraceae	Dalim	Barks	Dysentery. 100g bark is grinded, mixed with common salt and water and taken twice daily for 7 days.
23	<i>Nyctanthes arbor tristis</i>	Oleaceae	Sheuly	Leaves	Fever. 50g juice obtained from leaves is taken twice daily for 5 days.
24	<i>Hibiscus rosa sinensis</i> L.(red-flowered)	Malvaceae	Rokto joba	Leaves	Lack of calcium. 25g leaf juice is taken twice daily for 21 days.
25	<i>Azadirachta indica</i> A.Juss. L.(red-flowered)	Meliaceae	Neem	Stems	Dental diseases, scabies. Young stems are crushed and applied to affected area.
26	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Kathal	Gum	Cracked foot, piles. 25g gum is applied to the affected area.
27	<i>Moringa oleifera</i> Lam.	Moringaceae	Sajina	Barks, roots	Sterility. 100g mixture of barks and roots are grinded and taken once daily for 2 months.
28	<i>Musa sapientum</i> L.	Musaceae	Kola	Gum	Piles. 25g gum obtained from the tree is taken once daily for 30 days.
29	<i>Psidium guajava</i> L.	Myrtaceae	Piara	Leaves	Piles. 100g juice obtained from crushed leaves is taken twice daily.
30	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Durba	Whole plant	Stop bleeding. 100g whole plant paste is applied to cuts and wounds daily till cure.
31	<i>Polygonum hydropiper</i> L.	Polygonaceae	Bish katali	Leaves	Insect bite. 50g leaf paste is applied to affected area.
32	<i>Nigella sativa</i> L.	Ranunculaceae	Gol morich	Seeds	Rabies, toothache, blood dysentery. 50g of seed powder is taken daily till cure.
33 in	<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	Boroi	Leaves	Piles, tooth problem. 100g leaves are boiled water containing common salt and taken twice daily for 21 days.
34	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	Bel	Fruits	Dysentery, peptic ulcer. 250g of juice is collected from fruits and taken every morning on an empty stomach.
35	<i>Citrus acida</i> Roxb.	Rutaceae	Lebu	Fruits	Hair dandruff, vomiting.
36 the	<i>Glycosmis pentaphylla</i> Retz.	Rutaceae	Hotigila	Leaves, stems	Jaundice. 20g of leaves and 40g of stems of plant is boiled with 20 pieces of mango bark and then mixed with 20 liters of water. The patient is bathed in this water mixture for 1 week.
37	<i>Mimusops elengi</i> L.	Sapotaceae	Bokul	Seeds	Dental diseases. 20g paste of seeds is chewed thrice daily.
38	<i>Capsicum frutescens</i> L.	Solanaceae	Morich	Seeds	Rabies, toothache, blood dysentery.
39	<i>Datura stramonium</i> L.	Solanaceae	Datura	Leaves, seeds	Coughs, mumps. 100g of leaf paste is mixed with 50g of mustard oil and massaged on the chest thrice daily for 3 days as remedy for coughs. 30g powdered dried root is mixed with 50g water and taken daily for 5 days for mumps.
40	<i>Solanum nigrum</i> L.	Solanaceae	Kata begun	Roots	Abscess, chicken pox. 20g root paste is applied to affected areas.
41	<i>Abroma augusta</i> L.	Sterculiaceae	Ulot kombol	Leaves	Sex stimulant. 50g juice obtained from crushed leaves is taken with honey twice daily for 14 days.
42 is	<i>Centella asiatica</i> (L.) Urb.	Umbelliferae	Thankuni	Whole plant	Body ache, dysentery. 50g whole plant paste taken with rice twice daily for 10 days.
43	<i>Cissus quadrangularis</i> L.	Vitaceae	Harjora	Whole plant	Bone fracture. 100g paste of whole plant is applied to the fractured area twice daily for 7 days.
44	<i>Curcuma longa</i> L.	Zingiberaceae	Holud	Rhizome	Acne. Paste of 50g rhizome is applied once every day before bath.

Table 2: Percentage use of various plant parts by Kavirajes of four villages in Daudkandi sub-district, Bangladesh

Plant part used	Percent (%) of use
Whole plant	7.5
Leaves	45.3
Stems	3.8
Barks	5.7
Roots	13.2
Flowers	3.8
Fruits	7.5
Seeds	7.5
Gum	3.8
Rhizome	1.9

Discussion:

Several plants obtained in the present survey have been scientifically studied for their pharmacological activities. The scientific reports validate the use of the medicinal plants by the Kavirajes. *Justicia adhatoda*, used by the Kavirajes for treatment of coughs, reportedly demonstrated antitussive effect on mechanical or chemical stimulation-induced coughing in guinea pigs and rabbits (Dhuley, 1999). A bronchodilator alkaloid, vasicinone, has also been isolated from the plant (Amin and Mehta, 1959).

The usefulness of *Terminalia arjuna* (used by the Kavirajes to treat heart diseases) has been reviewed by Dwivedi (2007). The beneficial effects of this plant have been reported in patients with myocardial infarction with angina and/or ischemic cardiomyopathy (Dwivedi and Jauhari, 1997). It has been shown that crude bark of this plant augmented endogenous anti-oxidant compounds of rat heart and also prevented oxidative stress associated with ischemic-reperfusion injury of the heart (Gauthaman *et al.*, 2001). Extract of the bark of this plant, when given to patients with stable angina along with provokable ischemia on treadmill exercise, has been shown to improve clinical and treadmill exercise parameters compared to placebo trials (Bharani *et al.*, 2002). The cardioprotective effect of an alcoholic extract of bark has been shown in isoproterenol-induced myocardial injury in Wistar albino rats (Karthikeyan *et al.*, 2003). The bark also reportedly protected rabbit heart against ischemic-reperfusion injury (Gauthaman *et al.*, 2005). The bark powder also significantly decreased ischemic mitral regurgitation following acute myocardial infarction (Dwivedi *et al.*, 2005). The protective activity of ethanolic extract of bark of the plant against carbon tetrachloride-induced cardiac oxidative stress has been reported in mice [19]. The protective effect of bark of this plant has also been reported against doxorubicin-induced cardiotoxicity in male Wistar rats (Singh *et al.*, 2008), and against sodium fluoride-induced oxidative stress in murine heart (Sinha *et al.*, 2008).

The healing effects of *Cissus quadrangularis* L. on bone fractures have been well established (Udupa *et al.*, 1961; Udupa and Prasad, 1962; 1964; Chopra *et al.*, 1976). Notably, the plant is used by the Kavirajes for treatment of bone fractures. Ethanol extract of the plant reportedly demonstrated anti-osteoporotic effect in ovariectomized rats (Shirwaikar *et al.*, 2003). Extract of the plant has also been shown to enhance biomineralization in osteoblasts (Parisuthiman *et al.*, 2009).

That the medicinal plants used by the Kavirajes of the four villages surveyed in Daudkandi sub-district do not owe any success in treatments due to placebo effects have been demonstrated clearly for three plants, where the relevant pharmacological activities have been studied. Other plants used by the Kavirajes need to be studied only for validation of their use by the Kavirajes, but also for their potential in obtaining newer and more efficacious drugs. Ethnomedicine has played and is still playing an important role in novel drug discoveries. Furthermore, newer discoveries on medicinal plants used by the Kavirajes can lead to sustainable conservation efforts to save these plants, which are rapidly dying out in Bangladesh because of gradual loss of their natural habitat.

References

- Rahmatullah, M., D. Ferdausi, M.A.H. Mollik, R. Jahan, M.H. Chowdhury and W.M. Haque, 2010. A Survey of Medicinal Plants used by Kavirajes of Chalna area, Khulna District, Bangladesh. *African Journal of Traditional, Complementary and Alternative Medicines*, 7(2): 91-97.
- Hossan, M.S., A. Hanif, B. Agarwala, M.S. Sarwar, M. Karim, M.T. Rahman, R. Jahan and M. Rahmatullah, 2010. Traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases. *Ethnobotany Research and Applications*, 8: 61-74.
- Nawaz, A.H.M.M., M. Hossain, M. Karim, M. Khan, R. Jahan and M. Rahmatullah, 2009. An ethnobotanical survey of Rajshahi district in Rajshahi division, Bangladesh. *American Eurasian Journal of Sustainable Agriculture*, 3(2): 143-150.

- Rahmatullah, M., D. Ferdausi, M.A.H. Mollik, M.N.K. Azam, M.T. Rahman and R. Jahan, 2009. Ethnomedicinal Survey of Bheramara Area in Kushtia District, Bangladesh. *American Eurasian Journal of Sustainable Agriculture*, 3(3): 534-541.
- Rahmatullah, M., A. Noman, M.S. Hossan, M.H. Rashid, T. Rahman, M.H. Chowdhury and R. Jahan, 2009. A survey of medicinal plants in two areas of Dinajpur district, Bangladesh including plants which can be used as functional foods. *American Eurasian Journal of Sustainable Agriculture*, 3(4): 862-876.
- Rahmatullah, M., A.K. Das, M.A.H. Mollik, R. Jahan, M. Khan, T. Rahman and M.H. Chowdhury, 2009. An Ethnomedicinal Survey of Dhamrai Sub-district in Dhaka District, Bangladesh. *American Eurasian Journal of Sustainable Agriculture*, 3(4): 881-888.
- Mia, Md. M.K., M.F. Kadir, Md. S. Hossan and M. Rahmatullah, 2009. Medicinal plants of the Garo tribe inhabiting the Madhupur forest region of Bangladesh. *American Eurasian Journal of Sustainable Agriculture*, 3: 165-171.
- Martin, G.J., 1995. *Ethnobotany: a 'People and Plants' Conservation Manual*, Chapman and Hall, London, pp: 268.
- Maundu, P., 1995. Methodology for collecting and sharing indigenous knowledge: a case study. *Indigenous Knowledge and Development Monitor*, 3: 3-5.
- Dhuley, J.N., 1999. Antitussive effect of *Adhatoda vasica* extract on mechanical or chemical stimulation-induced coughing in animals. *Journal of Ethnopharmacology*, 67: 361-365.
- Amin, A.H., and Mehta, D.R., 1959. A bronchodilator alkaloid (vasicinone) from *Adhatoda vasica* Nees. *Nature*, 184 (Suppl 17): 1317.
- Dwivedi, S., 2007. *Terminalia arjuna* Wight & Arn. – a useful drug for cardiovascular disorders. *Journal of Ethnopharmacology*, 114: 114-129.
- Dwivedi, S. and Jauhari, R., 1997. Beneficial effects of *Terminalia arjuna* in coronary artery disease. *Indian Heart Journal*, 49: 507-510.
- Gauthaman, K., M. Maulik, R. Kumari, S.C. Manchanda, A.K. Dinda and S.K. Maulik, 2001. Effect of chronic treatment with bark of *Terminalia arjuna*: a study on the isolated ischemic-reperfused rat heart. *Journal of Ethnopharmacology*, 75: 197-201.
- Bharani, A., A. Ganguli, L.K. Mathur, Y. Jamra, and P.G. Raman, 2002. Efficacy of *Terminalia arjuna* in chronic stable angina: a double-blind, placebo-controlled, crossover study comparing *Terminalia arjuna* with isosorbide mononitrate. *Indian Heart Journal*, 54: 170-175.
- Karthikeyan, K., B.R. Bai, K. Gauthaman, K.S. Satish and S.N. Devaraj, 2003. Cardioprotective effect of the alcoholic extract of *Terminalia arjuna* bark in an in vivo model of myocardial ischemic reperfusion injury. *Life Sciences*, 73: 2727-2739.
- Gauthaman, K., S.K. Banerjee, A.K. Dinda, C.C. Ghosh and S.K. Maulik, 2005. *Terminalia arjuna* (Roxb.) protects rabbit heart against ischemic-reperfusion injury: role of antioxidant enzymes and heat shock protein. *Journal of Ethnopharmacology*, 96: 403-409.
- Dwivedi, S., A. Aggarwal, M.P. Agarwal and S. Rajpal, 2005. Role of *Terminalia arjuna* in ischaemic mitral regurgitation. *International Journal of Cardiology*, 100: 507-508.
- Manna, P., M. Sinha and P.C. Sil, 2007. Phytomedicinal activity of *Terminalia arjuna* against carbon tetrachloride induced cardiac oxidative stress. *Pathophysiology*, 14: 71-78.
- Singh, G., A.T. Singh, A. Abraham, B. Bhat, A. Mukherjee, R. Verma, S.K. Agarwal, S. Jha, R. Mukherjee and A.C. Burman, 2008. Protective effects of *Terminalia arjuna* against Doxorubicin-induced cardiotoxicity. *Journal of Ethnopharmacology*, 117: 123-129.
- Sinha, M., P. Manna and P.C. Sil, 2008. *Terminalia arjuna* protects mouse hearts against sodium fluoride-induced oxidative stress. *Journal of Medicinal Food*, 11: 733-740.
- Udupa, K.N., H.J. Arnika and L.M. Singh, 1961. Experimental studies of the use of '*Cissus quadrangularis*' in healing of fractures. II. *Indian Journal of Medical Sciences*, 15: 551-557.
- Udupa, K.N. and G.C. Prasad, 1962. *Cissus quadrangularis* in healing of fractures. A clinical study. *Journal of Indian Medical Association*, 38: 590-593.
- Udupa, K.N. and G.C. Prasad, 1964. Further studies on the effect of *Cissus quadrangularis* in accelerating fracture healing. *Indian Journal of Medical Research*, 52: 26-35.
- Udupa, K.N. and G. Prasad, 1964. Biomechanical and calcium-45 studies on the effect of *Cissus quadrangularis* in fracture repair. *Indian Journal of Medical Research*, 52: 480-487.
- Chopra, S.S., M.R. Patel and R.P. Awadhiya, 1976. Studies of *Cissus quadrangularis* in experimental fracture repair: a histopathological study. *Indian Journal of Medical Research*, 64: 1365-1368.
- Shirwaikar, A., S. Khan and S. Malini, 2003. Antiosteoporotic effect of ethanol extract of *Cissus quadrangularis* Linn. on ovariectomized rat. *Journal of Ethnopharmacology*, 89: 245-250.
- Parisuthiman, D., W. Singhatanadgit, T. Dechatiwongse and S. Koontongkaew, 2009. *Cissus quadrangularis* extract enhances biomineralization through up-regulation of MAPK-dependent alkaline phosphatase activity in osteoblasts. *In Vitro Cellular & Developmental Biology – Animal*, 45: 194-200.