

Daruharidra (*Berberis aristata*): Review based upon its Ayurvedic Properties

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ABSTRACT

Berberis aristata is also known as daruharidra which is a famous plant and used in various medicinal systems like Ayurveda, Homeopathy, Unani, Chinese and Allopathy for a very long time. It is a spinous, hard, yellowish herb belongs to the family *Berberidaceae*. The plant is distributed in sub- Himalayan regions, Sri Lanka, Bhutan and hilly areas of Nepal. It played a significant role as an herbal remedy for more than 2500 years. It was used by ancient Egyptians to anticipate plague disease. European herbalists used this plant to treat liver and gall bladder disorders during the early middle ages. Russian therapists used *B. aristata* plant to cure inflammation, high blood pressure and abnormal menstrual cycle. It is used as a bitter tonic, stomachic, cholagogue, antiperiodic and alternative by American Indians to cure intermittent fever, neuralgia and menorrhagia. In the traditional medicinal system, the plant is used to treat skin diseases, menorrhagia, diarrhea, eye problem inflammation and wound healing. Fruit of the plant is a rich source of Vitamin C. The main active constituent of the plant is Berberine found mainly in its roots. The most important formulation of this plant is 'Rashut' that is acts as a tonic as well as blood purifier and also used to treat ulcer and ophthalmic diseases. Reported clinical and experimental studies showed that the plant possesses various pharmacological properties like antimicrobial, anti-inflammatory, analgesic, antipyretic, hepatoprotective, immunomodulatory and cardiotoxic activity.

Keywords- Daruharidra, Antidiabetic, Rasapanchak, Ayurveda, Berberine.

I. INTRODUCTION

Herbal plants are considered as a source of traditional medicines and are used in the Indigenous medicinal system of India from ancient times. About 6000 species of higher plant are used in folk healthcare tradition [1]. As per WHO (world health organization) report, there are about 4 billion people of the world presently utilize herbal medicines as their primary health care or as an alternative medium of medicine [2]. The use

of plants for therapeutic purposes from the ancient period forms the origin of many modern medicines [3]. Herbal medicines are considered as the major healthcare provider in the whole world mainly in rural and remote areas [4]. As the herbal plants are source of several medicines it has gained wide importance in recent years due to its fewer side effects and more results than allopathic medicines. The formulations made from these herbal plants are used in the ayurvedic and Unani medicinal systems to cure a variety of diseases [5]. Moreover, there are about 250,000 – 400,000 plant species out of which only 6% have been studied for their biological activity while 15% have experimented for phytochemical studies. Therefore, it is necessary to investigate the herbal plants to analyze their therapeutic importance [6].

Berberis aristata is commonly known as Daruharidra, Daru Haldi, Indian barberry, Tree turmeric, Chitra. It is a spinous, hard, yellowish herb belongs to the family *Berberidaceae*. This plant is mainly grown in the sub- Himalayan region, Nilgiri hills of southern India and hilly areas of Nepal up to an altitude of 2000 to 3500 meters [7]. It is considered the most important herbal plant in the Ayurveda, Siddha and Unani medicinal system due to its medicinal importance [8]. The roots of the plant are considered as the official source of drug [9]. Traditionally, the plant is used as a tonic, demulcent, diaphoretic, diuretic and alternative to treat diseases like wound healing, skin diseases, rheumatism, snakebite, menorrhagia, jaundice and eyes problem [10,11]. The main alkaloid component of the plant is Berberine which is present either in leaves, roots, rhizomes and stem bark. Reported studies have shown that the stem and root part of *Berberis aristata* is sold as Daruharidra in India. The hypoglycemic activity of the plant was first reported in 1988 when this component is prescribed to cure diarrhea and diabetic patients [12]. In India and Nepal, this plant is used to cure allergies, metabolic disorder, cholera, acute diarrhea, latent malaria, amoebiasis, ophthalmia, eye diseases and act as a laxative in the traditional medicinal system [13,14,15]. Reported studies showed that

Berberine component of the plant possesses pharmacological activity and is used in the various medicinal system and act as antimicrobial, anti-inflammatory, analgesic, antipyretic, hepatoprotective, immunomodulatory and anti-depressant agent [16]. The plant is known by different names in different states of India and other countries (Table no. 1). Taxonomical classification is shown in table no. 2.

Table 1: Vernacular names of *Berberis aristata* [17,18]

English	Indian beriberi, Tree Turmeric
Hindi	Chitra, Chotra, Dahaldi, Kashmal, Kashmar, Raswat
Bengali	Daruharidra, darhaldi
Greek	Lykion indikoc
Gujrat	Daruhalad
Kannada	Doddamaradarisina
Malayalam	Maradarisina, Maramanjil
Marathi	Daruhalad
Oriya	Daruharidra, Daruhalidi
Punjabi	Chitra, Kasmal, Simlu, Sumlu, Daruhaldi
Tamil	Mullukala, Usikkala, Garamenjil
Telugu	Kasturipuspu
Sanskrit	Katamkateri, Dirvi, pitadaru, kata, suvarnavarna
Himachal Pradesh	Rasont, kashmal
Nepal	Chitra, chutro

Table 2. Taxonomical classification of *B. aristata* [19]

Taxonomical rank	Taxon
Kingdom	Plantae
Division	Phanerogamea
Sub-division	Angiospermea
Class	Dicotyledonae
Sub-class	Polypetalae
Group	Thalamiflorae
Order	Ranunculales
Family	<i>Berberidaceae</i>
Genus	<i>Berberis</i>
Species	<i>aristata</i>
Common name	<i>Daruharidra</i>



Figure 1: *Berberis aristata* (daruharidra)

II. DISTRIBUTION

a) Botanical description of *berberis aristata*

Berberis aristata (fig. 1) is a vertical spinous, glabrous herb that belongs to the family *Berberidaceae*. The height of the plant ranges from 2 to 3meter. It is woody hard with yellow to brown bark from outside and yellow from inside. The thorns present are modified leaves, three-branched and 1.5cm in length which can be easily removed by hands in longitudinal strips [20].

Leaves: Leaves are present in cluster form consist of 5-8, spinous, simple, lanceolate, leathery, toothed, sessile, verticillate that is 4.9cm in length and 1.8cm in breadth. Leaves are light green from the ventral surface and deep green from the dorsal surface with reticulate pinnate venation [21].

Flower: Flowers are yellow, complete, perigynous, hermaphrodite, actinomorphic, racemose with 11 to 16 flowers per raceme, with an average diameter of the fully opened flower is 12.5mm. The calyx is polysepalous with three small and three large sepals that are 4 to 5mm long. Corolla is yellow, polypetalous with 6 petals. Polyandrous androecium contains 6 stamens that are 5-6mm long and a female reproductive structure(gynoecium) which is 4-5mm long and is composed of broad stigma and short style. The flowering starts in mid-march and lasts throughout April month [22].

Fruit: The fruit is edible, acidic, succulent, ovoid to elliptical, bright red covered with flowers. The length of the fruit is approximately 7mm and 4mm in breadth while the weight is about 227mg [23].

Seed: Seeds are yellow to pink, 2 to 5 in number weighing 25mg and 29ml in volume [24].

b) Geographical Distribution of *Berberis aristata*

The plant *Berberis aristata* is native to Nepal and is widely distributed in India, Sri Lanka, Bhutan and Asia [25]. In India, it is mainly found in the sub-Himalayan region at an altitude of 1000-3000meter, Nilgiri hills in South India at an altitude of 1000- 2400 meter Jammu and Kashmir, Himachal Pradesh, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Uttrakhand, Sikkim and grown up to an altitude range between 2000 to 3500 meter [26,27].

III. PHYTOCHEMICAL CONSTITUENTS OF *BERBERIS ARISTATA*

Almost all the part of the *Berberis aristata* contains various chemical constituents. The major chemical constituents present in *B. aristata* plant are alkaloids. Berberine is considered one of the most important alkaloid components present in *B. aristata* plant. The root bark of the *B. aristata* plant contain protoberberine alkaloid called Karachine, dihydrokarachine, tetrahydropalmatine, tetrahydroberberine, epiberberine palmatine, palmatine dehydrocaroline, jatrorrhizine, columbamine and palmatine chloride [28]. Other alkaloids extracted are aromoline, oxyberberine, berbamine, oxyacanthine and berberine chloride [29,30]. Alkaloids like pseudopalmatine chloride, pseudoberberine chloride, taxilamine, pakistanine and 1-O-methylpakistanine were also extracted from the bark of plant [31,32]. The flower of *B. aristata* plant contains polyphenolic flavonoids named quercetin, meratin, rutin [33]. Other acids present are E- caffeic acid and chlorogenic acid [34]. The aliphatic hydrocarbon named n- docasane is also present in the ethanolic extract of heartwood [35]. Cadmium, lead, chromium, zinc, iron and manganese are the heavy metals present in the rhizome part of the plant [36]. The structures of some major phytochemical constituents are shown below in figure 2

IV. THE TRADITIONAL AND MODERN VIEW

A. Folk Uses

Berberis aristata commonly known as Daruharidra is an important herbal plant that is used as a traditional medicine in various communities. It played a significant role as an herbal remedy for more than 2500 years. It was used by ancient Egyptians to anticipate plague disease. European herbalists used this plant to treat liver and gall bladder disorders during the early middle ages. Russian therapists used *B. aristata* plant to cure inflammation, high blood pressure and abnormal menstrual cycle. It is used as a bitter tonic, stomachic, cholagogue, antiperiodic and alternative by American Indians to cure intermittent fever, neuralgia and menorrhagia [37]. In the Unani medicinal system, it is used to treat leprosy and the root extract of the plant is used to cure skin problems like ulceration of the skin, abrasions and also act as a blood purifier [38,39] In India, it is used to cure allergies, ophthalmia, metabolic disorders eye diseases and as a laxative. Traditionally, it is considered as one of the most significant plants in 73 plant species which is used to cure skin-related problems in Nepal and its surrounding villages [40]. The formation of multi- herbal drugs containing *B. aristata* is used to cure bleeding piles disorder in rural parts of India [41].

Reported studies have revealed that the aqueous methanolic extract of the plant is used traditionally to treat osteoporosis diseases, joint pain and menopause [42]. The ethnobotanical studies revealed that the decoction of *B. aristata* leaves named Rasaut is used to cure cholera, diarrhea, menorrhagia, jaundice, ear and eye infections and urinary tract disorders. Rasaut formulation also shows antimicrobial, anti-inflammatory, antifungal, analgesic, antibacterial and antipyretic activities [43,44,45,46]. In the Himalayan regions of India, the root decoction is used to cure eye diseases in Bhotiya communities [47]. It is also used to cure skin diseases, jaundice, malaria and piles in Malani tribal communities of Himachal Pradesh, India. Also, the fruit of the plant act as an anti-scorbutic and laxative [48]. The root of the plant is used to treat jaundice and is used as psychomedicine to treat exorcism in children in Garhwal Himalaya, India [49,50]. In Nepal, the fruit part and leaf juice are used to cure diarrhea and dysentery and decoction of root and bark is used in the treatment of fever and jaundice [51]. In the Sikkim and Darjeeling part of India, the plant extract is used to treat diabetes and acts as anti-hepatopathic [52].

B. *Berberis aristata* in Ayurveda

Ayurveda is a conventional system of medicine developed around 5000 years ago. *B. aristata* plant is considered the most significant plant in Ayurveda. This herb is mentioned in ancient books of Ayurveda, Charaka and Susruta for its various medicinal properties to treat a variety of diseases [53]. It is used in the Ayurvedic medicinal system since ancient times. In Ayurveda, the medicinal system *Berberis aristata* is used to treat foe dysentery, wound healing, skin disease, inflammation, diarrhea, jaundice, menorrhagia and eye diseases [54]. The properties (Rasapanchak) of *Berberis aristata* is shown in table no. 3.

Ayurvedic formulations: The most important ayurvedic formulations of this plant is 'Rashut' which is used to cure ophthalmic, ulcer diseases and acts as a laxative, tonic and blood purifier [55,56]. The major formulations of this plant are Darvyadi kvatha, Darvyadi leha, Darvyadi taila, Rasanjana, Dasanga lepa, Rasanjana, Khadiradi Vati, Mahamanjithadi Kashayam, Mahayograj Guggulu [57].

Table 3: Rasapanchak (Properties) of *Berberis aristata* [58]

Rasa/ Taste	Katu / Bitter, Tikta / astringent
Vipak / Potency	Katu / Bitter
Virya / metabolic property	Ushna / Heat
Guna / Physical property	Ushna / heat, Ruksha / dry

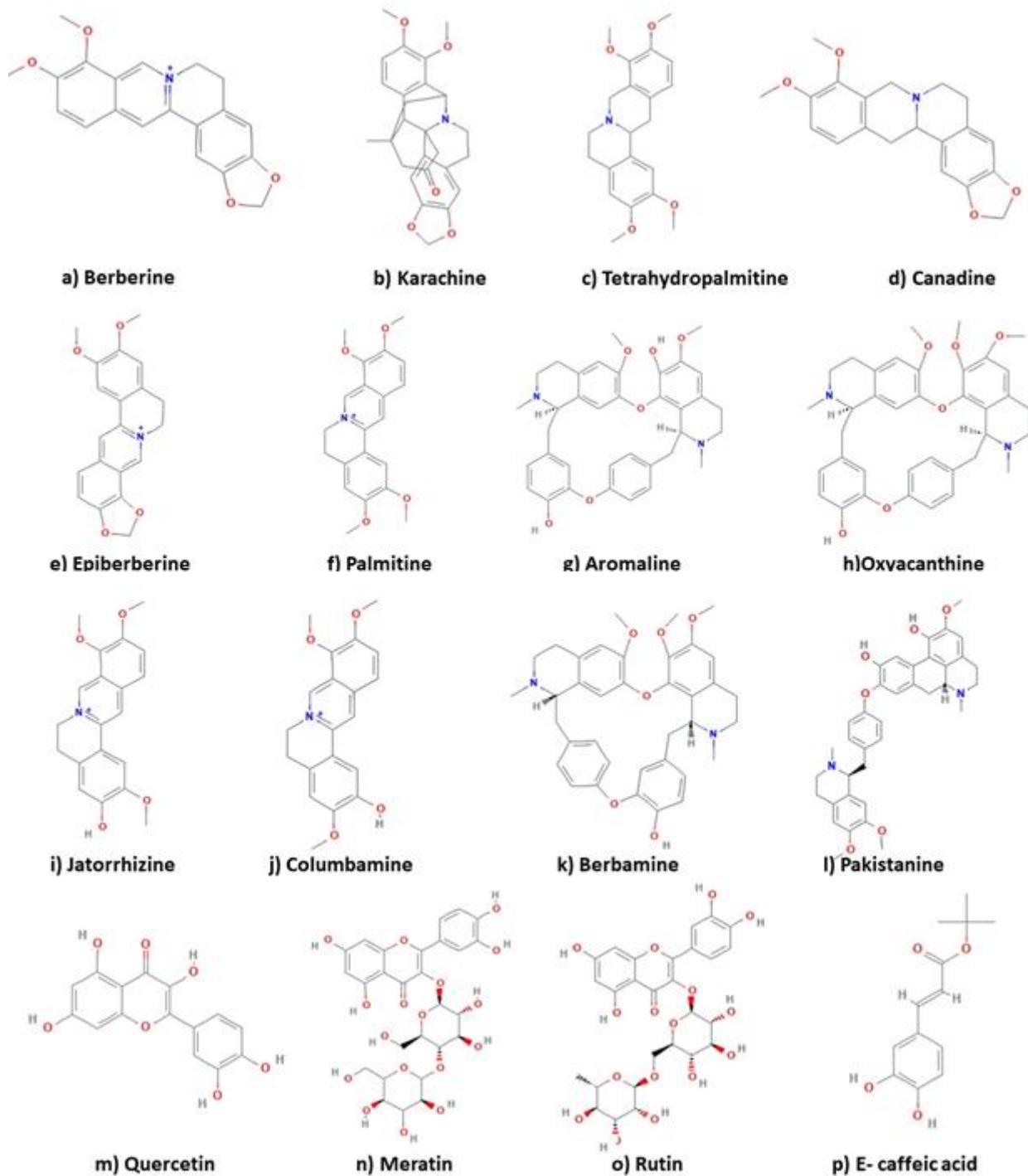


Figure 2: Chemical structures of some major phytochemical constituents of *Berberis aristata*

Karma (Actions) [59]

Shothahara: It is used to treat oedema.
Vedana sthapan: It acts as analgesic by reducing pain.
Vrana shodhana: It helps in wound healing.
Deepan: It acts as Apetizer.
Pitta sarak: It maintains metabolism and used to treat liver, jaundice, digestive and pancreatic disorders.
Grahi: It helps to cure diarrhea and dysentery problems.
Rakta shodhaka: It acts as blood purifier.

Garbhashayashothahara: It improves uterine health and used to treat pelvic inflammatory diseases.
Stravahara: It treats abnormal discharge problem.

Properties of *B. aristata* [59]

Lekhaniya: It is helpful in reducing toxicity and unnecessary fat.
Arshoghna: It acts as anti-haemorrhoidal
Stanyasodhana: It acts as a lactote purant.
Ropana: It acts as a wound healer.

Svedala: It promotes sweating.

Rasayana: It acts as a rejuvenating agent.

Kandughna: It is helpful in treating skin disorders and acts as anti-pruritic agent.

Twacha: It is helpful to treat skin diseases and also use in cosmetics products.

Taapkaram: It maintains the body temperature.

Shwasanasanathan: It is helpful in treating respiratory diseases.

C. Modern View

In the modern scenario, adulteration in herbal products is a major crisis that is dangerous to the herbal drug industry and the research going on these important natural products [60]. The demand for herbal medicines rises due to which the original product is mixed with inferior defective, spoiled, useless and harmful substances which adversely affect the health of people. Nowadays, people are money-minded and only think of their benefit. Due to which they have started substitution of cheaper inferior drugs of same morphology with original drug [61]. Due to the overexploitation, deforestation and loss of habitat, herbal industries are facing the unavailability of the genuine plant as a result of which adulteration rises. Adulteration in natural products results in the poor quality of the product which can cause serious health problems like severe allergies [62,63]. It can lower down consumer confidence in herbal products and also result in decrease in the market value of the product. So it is necessary to develop an Herbal Authentication System (HAS) which can serve as a regulator and also helps in improving the quality of herbal trade [64].

V. REPORTED THERAPEUTIC USES OF BERBERIS ARISTATA

Berberis aristata is considered as the most important herbal plant. Reported pharmacological activities of *B. aristata* are proved by various scientific and experimental studies that are summarized below.

1. Hepatoprotective activity: An immunomodulation study was conducted in the golden hamster to evaluate the hepatoprotective activity of the plant. It was observed that the formulation containing *B. aristata* decreases the rate of infection in hepatic amoebiasis [65]. The aqueous methanolic extract of the plant possesses hepatoprotective action [66]. Other reported studies demonstrated that the berberine constituent of the plant showed hepatoprotective action when experimented in rats where cytochrome p-glycoprotein and P-450 regulates the hepatobiliary excretion and liver metabolism [67]. Berberine is found to be effective against liver fibrosis in the Chinese medicinal system [68].

2. Anti-inflammatory: Reported studies have revealed that the aqueous extract of roots of *B. aristata* possesses anti-inflammatory action when tested in rats at dosage 500-1000 mg/kg [69]. Similarly, the methanolic and aqueous extract of *B. aristata* and *C. fenestratum* showed

anti-inflammatory action when tested in carrageenan-induced raw paw edema in a rat model [70].

3. Antimicrobial: The alkaloid extract of the plant showed an antibacterial effect against trachoma [71]. Reported studies also revealed that berberine extract of the plant showed significant anti-microbial activity against the number of microbes including virus, bacteria, fungi, protozoans, helminths and chlamydia [72,73,74]. The herbal gel formulation contains *B. aristata* extract was found to be effective medicine against skin infections when tested in *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Corynebacterium* [75]. It was also reported that the root extract and hexane extract of the plant showed anti-fungal activity against different fungal pathogens [76].

4. Antidiarrheal: The *in vivo* and *in vitro* studies were carried out to confirm the anti-diarrheal activity of *B. aristata* plant [77]. Reported studies revealed that berberine constituent extracted from roots and barks of *B. aristata* plant showed inhibition of the secretory response of enterotoxins of *Vibrio cholera* and *E. coli* in rabbit ligated intestinal loop model and infant mouse assay [78]. Also, crude dried formulation of *B. aristata* plant inhibits cholera toxin-induced diarrhea [79,80].

5. Anti-diabetic: Various experimental studies revealed that the ethanolic extract of *B. aristata* showed anti-diabetic activity when experimented within alloxan-induced diabetic rats [81]. The alcoholic stem extract of *B. aristata* plant possesses anti-hyperglycemic activity [82]. DPP-IV inhibiting property of the plant showed potential anti-diabetic agent [83].

6. Anticancer: The methanolic extract of *B. aristata* plant was studied against human colon cancer cell line to evaluate anti-cancerous activity. It was found that methanolic extract of *B. aristata* showed concentration-dependent inhibition of HT29 cells [84]. Also, Berberine constituent extracted from *B. aristata* plant was found to show significant inhibition against carcinogenesis induced by 20-methylcholanthrene or Nnitrosodiethylamine, in a dose-dependent manner in small animals [85,86].

7. Antioxidant: The aqueous ethanolic extract of *B. aristata* plant was studied to find the antioxidant activity of the plant. The study was conducted in diabetic rats with safety parameters. It was found that the root extract of the plant showed decrease oxidative stress [87]. Also, a significant result was found when aqueous and methanolic extract of the plant was tested against CCl₄ induced liver injury [88].

8. Anti-platelet: Various scientific studies revealed that the alcoholic extract of *B. aristata* plant inhibits the PAF (platelet-activating factor) induced Aggregation of platelets and 3H- PAF binding when tested in rabbit platelets [89]. It was also reported that Berberine constituent of the plant inhibited the platelet aggregation by interfering with collagen-mediated adhesion process [90].

9. Cardiotonic: The fruit extract of the plant *B. aristata* plant exhibits positive inotropic action [91]. The biochemical study was conducted in healthy rabbits to evaluate the cardiovascular property of the plant. The

study revealed a significant decrease in serum cholesterol, triglycerides and low-density lipoprotein level and an increase in fibrinogen and thrombin levels [92].

Table 4: Reported pharmacological studies of *Berberis aristata* plant showing therapeutic properties.

S. No.	Extract	In vivo / in vitro	Pharmacological activity	Reference
1.	Aqueous and methanolic extract	Hamster, Rat model	Hepatoprotective, Anti-inflammatory	[65][66][67][68][69][70]
2.	Alkaloid and hexane extract	<i>Staphylococcus aureus</i> , <i>Pseudomonas aeruginosa</i> , <i>Corynebacterium</i>	Antimicrobial, Antibacterial, Antifungal	[71][72][73][74][75][76]
3.	Root extract	Rabbit, infant mouse essay	Antidiarrheal	[77][78][79][80]
4.	Ethanollic and alcoholic extract	Alloxan induced diabetic rat	Anti- glycemic	[81][82][83]
5.	Methanolic extract	Human colon cancer cell (clinical study)	Anti-cancerous	[84][85][86]
6.	Aqueous ethanolic extract	Diabetic rat	Antioxidant	[87][88]
7.	Alcoholic extract	Rabbit	Anti- platelet	[89][90]
8.	Fruit extract	Rabbit	Cardio tonic	[91]

VI. CONCLUSION

Berberis aristata commonly known as daruharidra is a significant medicinal plant used in Ayurvedic, Chinese, Unani and other medicinal systems in the world since ancient times. Traditionally, the plant is used as a tonic, demulcent, diaphoretic, diuretic and alternative to treat diseases like wound healing, skin diseases, rheumatism, snakebite, menorrhagia, jaundice and eyes problem. As per clinical and experimental studies, the chemical constituents of the plant-like berberine possess various pharmacological properties like anti-diabetic, anti-microbial, anti-cancer, antipyretic, hepatoprotective, ophthalmic and cardiotonic activity. This plant possesses significant medicinal value and needs more research and studies to develop more herbal and ayurvedic formulations. Although the results from this review are quite promising for the use of *B. aristata* plant to treat numerous diseases and disorders.

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