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## DIVERSE PHARMACOLOGICAL POTENTIALS OF *BETULA UTILIS*: A CRITICAL REVIEW

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**ABSTRACT:** Herbs have wide range of pharmacological activities including antibacterial, anti-inflammatory, anticancer, antioxidant, and anti-HIV gives them great potential as treatments for a wide variety of infectious disorders. The present review was emphasized on the evaluation of diverse pharmacological potentials of *Betula utilis* that have been confirmed by the researchers. Studies were analysed and extracted from the publications done at Scopus, PubMed, Web of Science, and other reputed journals. The bark of the *betula utilis* tree has antiseptic and carminative properties. *Betula utilis*, a common medicinal plant, is just one of the more than a thousand plant species known to contain significant pharmacological characteristics. *Betula utilis* belongs to Betulaceae family that can be found on the moraines around Bhojbasia in Uttarakhand, India, not far from the mouth of the Gangotri glacier. A moderate-sized tree that can reach heights of up to 20 metres. Bark has shown different chemical constituents i.e., acetylo-heanolic acid, lupeol, oleanolic acid, lupenone etc. Traditional use shows that bark has been used in treating a wide range of conditions, including bronchitis, convulsions, leprosy, blood disorders, contraceptive, antibacterial, fragrant, carminative, ear infections etc. It has been shown to have potent anticancer effects. Because to its many beneficial pharmacological properties, including antibacterial, anticancer, anti-obesity, antihyperglycemic, anti-inflammatory, antioxidant, and anti-HIV properties. In conclusion, *Betula utilis* is a promising research-oriented plant that might be effective in the cure and management of numerous medical conditions/ ailments through incorporating in different suitable dosage forms.

**Keywords:** Lupeol, botulin Anticancer, anti-hyperglycaemia, and anti-obesity.

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## INTRODUCTION

Herbs have wide range of pharmacological activities including antibacterial, anti-inflammatory, anticancer, antioxidant, and anti-HIV gives them great potential as treatments for a wide variety of infectious disorders [1]. Different alkaloids in the plant have different medicinal effects. The bark of the betula utilis tree has antiseptic and carminative properties. Betula utilis, a common medicinal plant, is just one of the more than a thousand plant species known to contain significant pharmacological characteristics [2]. There is no denying the importance of medicinal plants to human health. Traditional medicine, which is mostly based on plant material, is used by almost 80% of the global population. Himalayan birch, or Betula utilis, is a common name.

It has different names in different languages-

English- Himalayan birch

Kannada- bhuyapatra

Malayalam- Bujjaramam



**Fig 1. Depiction of Betula utilis plant**



### **Taxonomy [3]**

Kingdom: Plantae

Division: Magnoliophyta

Class: Mangoliopsida

Family: Betulaceae

Genus: *Betula*

Species: *utilis*

### **Description and Distribution**

*Betula utilis* belongs to Betulaceae family that can be found on the moraines around Bhojbasa in Uttarakhand, India, not far from the mouth of the Gangotri glacier [4]. A moderate-sized tree that can reach heights of up to 20 metres. The bark is smooth and shiny, with white horizontal stripes and crimson lenticels. Exfoliation of the outer bark occurs in broad, horizontal rolls [5]. The elliptic, ovate, and irregularly serrate leaves have an ovate-acuminate shape. The flowers, which hang down from the stems, bloom in May and June. The blooms are wind pollinated and monoecious, meaning that each individual blossom is either male or female. Little, thin, winged seeds. The plant thrives in well-drained soil, although its ideal environment is a combination of sand, loam, and clay. Soils ranging from acidic to alkaline are ideal for this plant. It requires only partial shade to thrive. Soil moisture is essential [6]. It has medicinal benefits including those that are contraceptive, antibacterial, fragrant, and carminative. Betulin, lupeol, oleanolic acid, acetyloleanolic acid, betulic acid, lupenonesitosterol, methyle betulonate, methylbetultriterpenoid, and karachic acid can all be found in the bark. Up to 12% of the weight of betulin can be found in *betula utilis*. It's fragrant and antibacterial, which is quite awesome [7].

### **Chemical Constituents**

Bark extracts has proved for following chemical constituents [8]-

- Botulin
- Acetylo-heanolic acid
- Lupeol
- Oleanolic acid
- Betulitic acid
- Lupenone
- Sitosterol

- Methyl betulonate
- Methylbetulate.

Essential oil from bark also have shown following moieties [24]-

- Geranic acid
- Seleneol
- Linalool
- ses-qui-phellendrene
- champacol
- 1,8-cineol
- linoleic acid (17.66%)
- myristic acid (15.9%)
- palmitic acid (9.09%),
- oleic acid (11.30%)
- geranic acid
- seleneol
- linalool
- sesquiphellendrene
- champacol
- 1,8-cineol.

### Traditional Uses

- ✚ Aromatic and antibacterial, karachicrustics (a triterpenoid) is useful for treating wounds. Malignant melanoma and liver and lung cancer growth are both inhibited by the anticancer drug Betulin [9].
- ✚ Phytochemical testing has revealed that this species contains high concentrations of alkaloids and antibacterial active polysaccharides [10].
- ✚ Firewood is made from wood, while paper is made from leaves. Asthma, a cold, malaria, a cough, gout, and rheumatism are all helped by it [11].
- ✚ Bark for treating a wide range of conditions, including bronchitis, convulsions, leprosy, blood disorders, and ear infections [12].
- ✚ In addition to its hepato-protective properties, it also has antibacterial, antioxidant, anti-inflammatory, anticancer, and anti-HIV properties.
- ✚ The healing properties of the plant are due to its alkaloids. Leaf for urinary tract infections, kidney and bladder stones [13].
- ✚ Bark for manufacturing wrapping material and roof building. Diuretics made from leaf decoction are popular.



- ✚ Fever and anxiety can both be alleviated with the help of bark paper. For domestic peace and harmony, papery bark is kept back for private use [14].
- ✚ It is an antiseptic that people use. Ploughs, spoons, and firewood are all made from the wood. Food, gums, and resins can all be derived from this plant.

### **Pharmacological Properties**

Ayurveda practitioners employ the bark to treat a wide range of conditions, including wound healing, leprosy, skin infections, bronchitis, convulsions, blood disorders, and ear problems. The tree is used for its several biochemical compositions with medicinal properties. Betulin, lupeol, acetyloheanolic acid, betulite acid, lupenone, -sitosterol, methyl betulonate, and methyl betulate are the primary biochemical components identified, whereas oleanolic acid, ursolic acid, and betulinic aldehyde are reported as secondary chemicals [15].

It has shown following pharmacological activities-

#### **Antifungal and Antimicrobial**

Essential oil extracted from *B. utilis* contains antimicrobial compounds as geranic acid, seleneol, linalool, sesquiphellendrene, champacol, and 1, 8-cineol, which are effective against human pathogenic bacteria and the fungus *Candida albicans* [16]. Antibacterial activity has been demonstrated for betulinic acid, an easily converted form of betulin, against a number of bacteria that pose serious health risks to humans, including *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella* spp., *Shigella* spp., *Staphylococcus aureus*, and *Streptococcus faecalis* [17].

#### **Anticancer**

Easily transformed into betulinic acid (3a-hydroxy-lup20(29)-en-28-oic acid), betulin is found in *Betula utilis*. Researchers found that betulinic acid reduces the development of liver and lung tumours [18].

Human melanoma, neuroectodermal, and malignant tumour cells have all been shown to be sensitive to betulinic acid's growth inhibition and apoptosis induction properties. Apoptosis in chemo selective cells has been reported to be triggered by a variety of anticancer drugs. Cell mortality, particularly that induced by chemotherapeutic drugs, can be attributed in large part to alterations in mitochondrial processes such permeability transition [19]. Many cancer cell lines, primary tumour tissues, and xenograft animal models have been used to investigate betulinic acid's antitumor cytotoxicity. In several studies, betulinic acid was found to be particularly harmful to melanoma cell lines.



### **Anti-Inflammatory**

Betula utilis extracts in both methanol and water have been shown to have free radical-scavenging properties, potentially halting the beginning of free radical chain reactions or slowing their progression as they spread through an organism. This suggests the plants have enhanced anti-inflammatory properties. Betula utilis was shown to have reduced lipoxygenase enzyme activity after inhibition. It may have anti-inflammatory effects by neutralising free radicals. Antioxidants have a profound effect on lipoxygenases (LOXs), possibly by scavenging lipidoxy or lipidperoxy-radicals produced in the course of enzymatic peroxidation and preventing the creation of lipid hydroperoxide. This can reduce the amount of lipid hydroperoxide available for the LOX catalytic cycle [20].

### **Anti-HIV**

Evidence suggests that betulinic acid can block the reproduction of HIV (Human Immunodeficiency Virus) type 1. Inhibitors of HIV-1 entrance and HIV-protease have been discovered to share structural similarities with betulinic acid derivatives. Many variants of betulinic acid have been found to block HIV-1 at an extremely early stage of the viral life cycle, suggesting that they may one day be helpful additions to the standard anti-HIV treatment regimen of reverse transcriptase and protease inhibitors [21].

### **Antioxidant**

Betulinic acid, which is derived from the bark of Betula utilis, has been shown to have powerful antioxidant action. In addition to its free radical scavenging activity, B. utilis also has free radical reducing activity, which may prevent the initiation of free radicals or slow the spread of free radical chain reactions during the oxidation mechanism. Further pharmacological effects need to be determined [22].

### **Anti-Obesity**

A study determined whether or not Betula utilis (BU) ethanolic extract has any anti-obesity effects in a rat model of high-fat diet-induced obesity and hyperlipidemia. After 10 weeks on the HFD, male rats were experimentally obese. Serum glucose, triglyceride (TG), total cholesterol (TC), and other lipoproteins were measured, as well as initial and end body weight, Lee index, Body mass index (BMI), fat pads weight, and other variables. Dose-dependent reduction of HFD-induced weight gain and increase in adipose tissue mass was observed when BU (100-400 mg/kg/day) was administered after 4 weeks on a high-fat diet. In addition, BU reduced the increases in blood glucose, TG, and TC that were brought on by the HFD. BU's potential as an anti-obesity treatment was on par with that of the popularly used medication orlistat. Our findings suggest that taking BU supplements can lead to a



reduction in body weight and an improvement in obesity-related blood biomarkers (TG, TC, and LDL), with the weight-reducing effect of BU perhaps being mediated by reduced fat absorption from the gastrointestinal tract [23].

### **Anti-Hyperglycaemic**

The entire plant extract of *Eclipta alba* (Asteraceae), root extract of *Berberis aristata* (Berberidaceae), and stem wood extract of *Betula utilis* (Beech) D. are all ethanolic extracts. In a single dosage trial with Streptozotocin-induced diabetic rats, *Betula utilis* D (Betulaceae), *Cedrus deodara* (Pinaceae) stem wood, and *Myristica fragrans* Houtt. (Myristicaceae) fruits caused a substantial drop in blood glucose profile of 7.5%, 8.3%, 9.2%, and 8.7%, respectively. *Terminalia chebula* (Combretaceae) fruit ethanolic extract reduced blood glucose levels in diabetic rats caused by Streptozotocin by about 8% in a single dosage experiment [25].

## **CONCLUSION**

The medicinal plant *Betula utilis* has many uses and is a rare source of certain phytochemical substances. Betulinic acid, a phytochemical found in *Betula utilis*, has numerous biological functions. It has been shown to have potent anticancer effects. Because to its many beneficial pharmacological properties, including antibacterial, anticancer, anti-obesity, antihyperglycemic, anti-inflammatory, antioxidant, and anti-HIV properties.

In conclusion, *Betula utilis* is a promising research-oriented plant that might be effective in the cure and management of numerous medical conditions/ ailments through incorporating in different suitable dosage forms.

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Nil.

## **CONFLICT OF INTEREST**

‘None’ conflict of interest was declared by the authors.



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