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**Review Article**

# Overview Blackberry (Rubus Fruticosus) in Treatment of Diabetes Mellitus

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## ABSTRACT

Diabetes mellitus is a chronic metabolic disease that affects millions of people around the world. Herbal medicines are now gaining attention due to their safety and effectiveness. Blackberry (Rubus fruticosus) is a common fruit that contains many bioactive compounds with antioxidant and antidiabetic properties. This review focuses on the potential role of blackberry in managing diabetes through its phytochemical components and mechanism of action. The paper also summarizes various research studies performed on blackberry and its extracts.Diabetes mellitus is one of the most common chronic diseases worldwide. It is characterized by elevated blood glucose levels caused by insufficient insulin production or insulin resistance. Recent studies have shown that natural plant-based products play an important role in diabetes management. Among these, the blackberry (Rubus fruticosus), a widely available fruit, has gained scientific attention for its potential anti-diabetic effects. The present review discusses the pharmacological actions, phytochemical constituents, mechanism of action, and clinical evidence supporting the role of blackberry in diabetes management.

## INTRODUCTION

Diabetes mellitus is one of the most common metabolic disorders worldwide. It occurs due to problems in insulin secretion or insulin action, leading to increased blood sugar levels. The disease can cause many complications like heart disease, kidney failure, and nerve damage. Synthetic drugs are available, but long-term use may cause side effects. Hence, researchers are focusing on herbal remedies. Blackberry (Rubus fruticosus) is a medicinal fruit known for its antioxidant and antidiabetic potential. This paper aims to review the role of blackberry in the treatment of diabetes.

### Diabetes Overview

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Diabetes mellitus is mainly of two types: Type 1 and Type 2. Type 1 is insulin-dependent, while Type 2 is due to insulin resistance. High blood glucose levels can lead to long-term damage to various organs. Controlling sugar levels through diet, exercise, and medicines is essential.

**Figure 1. blackberry (40)**

**Synonyms**

"In Australia, the most common member of the Rubus fruticosus L. complex is identified as a biotype of Rubus anglocandicans."(20)

Commonly referred to as blackberry, the plant scientifically known as Rubus fruticosus Linn. is also called bramble, European blackberry or wild blackberry. In local languages it may be called "jamun-jaisa ber" (Hindi), "karvand/black berry" (Marathi) and "krishnaver" (Sanskrit).(26)

**Biological Source**

Blackberry (Rubus spp.) is a berry fruit of the Rosaceae family, which has the advantages of strong ecological adaptability, easy cultivation, early yield and good economic benefits.(19)

**Family**: Rosaceae(19)

**Chemical Constituents**

Blackberry contains various bioactive compounds like quercetin, gallic acid, cyanidin-3-glucoside, catechins, and ellagic acid. These components have antioxidant, anti-inflammatory, and glucose-lowering properties. (21)&(22)

| Phytochemical | Chemical class | Pharmacological Role |
|---|---|---|
| Anthocyanins | Flavonoids | Antioxidant improves insulin sensitivity |
| Ellagic acid | Phenolic Compound | Anti-inflammatory. antioxidant |
| Tannin | Polyphenols | Reduces glucose absorption |
| Vitamin C and E | Vitamin | Prevents oxidative stress |
| Quercetin | Flavonoid | Improves β-cell function |

**Characteristics of Blackberry**

**Colour:** green. red. black. purple

**Taste:** sweet to slightly acidic

**Cultivation of Blackberry**

Blackberry cultivation is widespread across regions such as North America, Europe, Asia, South and Central America, and Africa. In recent years, numerous improved varieties with superior quality and higher yields have been adopted for commercial production.(23)

**Description of blackberry**

The blackberry species (Rubus fruticosus) commonly found in Britain has become naturalized across much of the world, including North America. Historical folk medicine records rarely specify the exact species used. Traditionally, blackberry root has been included in

decoctions to treat dysentery and has also been employed as a remedy for diarrhea.(16).

1. **Habit:** A perennial, semi-woody shrub whose stems (canes) arch or trail and can grow to around 3–6 m in length.(16)
2. **Stem:** Young stems are green, ridged and thorny; as they mature they become woody. The plant develops two kinds of canes: first-year "primocanes" which grow vegetatively and don't flower, and second-year "floricanes" which bear flowers and fruits.(16)
3. **Leaves:** They are arranged alternately; each leaf is compound (palmate) with typically 3 to 7 leaflets. The leaflets have serrated margins, a dark green rough upper surface, and a pale, hairy underside.(16)
4. **Flower:** Usually white to pale pink in colour. The flower structure includes 5 green persistent sepals, 5 delicate petals, numerous stamens and many free carpels. The flowers are borne in racemes or corymb-type inflorescences.(16)
5. **Fruit:** An aggregate fruit composed of many drupelets, conical or round in shape, changing colour from green to red to black-purple when ripe; the flavour is sweet with a slightly acidic note. Each drupelet contains one small seed.(16)
6. **Seed:** Each drupelet encloses a single small, hard, brown seed.(16)
7. **Root system:** A woody root-stock featuring a deep tap-root and laterally spreading suckers which enable vegetative propagation.(16)

**Structure of blackberry fruit (30)**

| Part | Description |
|---|---|
| Receptacle | Central white core around which drupelets are attached |
| Drupelets | Small, fleshy units containing single seeds |
| Epicarp | Thin outer skin, black when ripe |
| Mesocarp | Juicy and sweet pulp |
| Endocarp | Hard inner layer enclosing seed |

**Diagram of Blackberry fruit**


**Figure 1 (A) Rubus fruticosus. (B)Rubus ulmifolius (C).Morus nigra (31)**

**Role of Blackberry (Rubus fruticosus)**

Blackberry is a fruit belonging to the Rosaceae family. It is rich in vitamins, minerals, and phytochemicals such as flavonoids, anthocyanins, and tannins. These compounds play a key role in reducing oxidative stress, which is one of the main causes of diabetes.(24)&(25)

**Uses of Blackberry**

**A. Medical Uses**

1. As an antioxidant: helps counter oxidative stress and slows down the aging process.(28)
2. As an antidiabetic agent: aids in controlling blood glucose levels and enhancing insulin sensitivity.(27)
3. For cardioprotection: supports improving lipid profiles and lowering blood pressure(29).
4. As an anti-inflammatory: helps reduce inflammation in tissues.(28)
5. As an anticancer agent: thanks to compounds such as ellagic acid and anthocyanins.(27)
6. As an antimicrobial: works against both bacterial and fungal pathogens.(27)(28)
7. As an astringent: used for conditions like diarrhea, sore throat and oral ulcers.(28)

**B. Nutritional Uses**

Consumed fresh, or processed into jams, jellies, juices, wines and desserts

**Current Treatment Options**

Currently, diabetes is treated using drugs like insulin, metformin, sulfonylureas, and thiazolidinediones. However, these medicines may cause side effects such as weight gain, hypoglycemia, and gastrointestinal problems. This has encouraged the use of herbal plants as safer alternatives.

**Herbal Approach for Diabetes**

Many medicinal plants such as neem, fenugreek, bitter gourd, and blackberry are used in traditional medicine to manage diabetes. These herbs help in reducing glucose levels, improving insulin sensitivity, and providing antioxidant protection.

**4.6 Mechanism of Action**

The antidiabetic effect of blackberry is largely attributed to its capacity to boost insulin secretion and enhance glucose metabolism. Its flavonoids and anthocyanins diminish oxidative stress, thereby helping protect pancreatic β-cells from damage. These phytonutrients also improve insulin receptor sensitivity, which enables greater glucose uptake.(29)

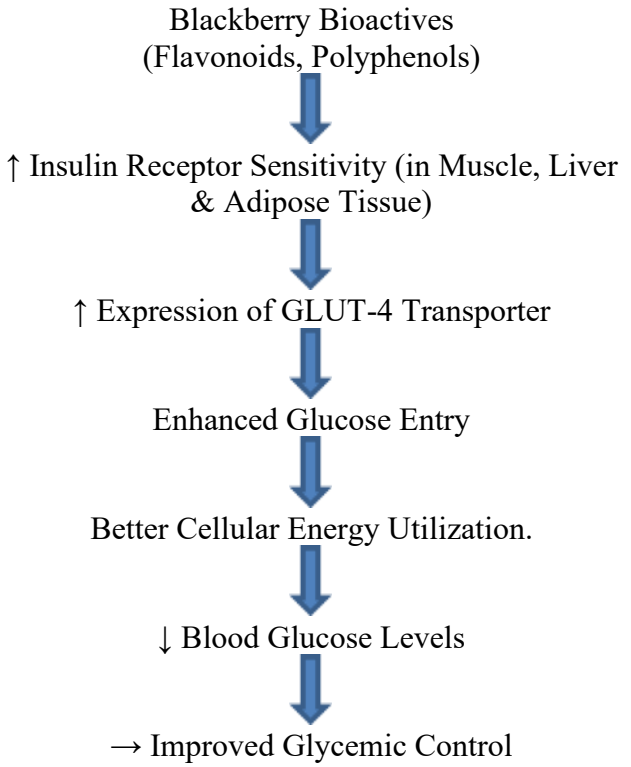
1. **Enhancement of Insulin Secretion**

**Mechanism**:

Active phytochemicals like anthocyanins and flavonoids enhance the activity of pancreatic β-cells, leading to increased insulin release.

**Result:** This promotes better insulin secretion, resulting in improved regulation of blood glucose levels.(31)

**2. Improvement in Glucose Uptake and Utilization(32)**




1. **Inhibition of Carbohydrate-Digesting Enzymes**

Blackberry Bioactives
(Anthocyanins, Ellagitannins

↓

Inhibit Digestive Enzyme (α-Amylase and α-Glucose)

↓

↓ Carbohydrate Breakdown in Intestine

↓

↓ Glucose Absorption into Bloodstream

↓

Reduced Post-Meal Blood Sugar Spikes

↓

→ Better Glycemic Control

**2. Antioxidant and β-Cell Protection**

Blackberry Bioactives
(Flavonoids, Ellagic Acid, Quercetin)

↓

Antioxidant Activity

↓

→ Neutralization of Reactive Oxygen Species (RO)
Protection of Pancreatic β-Cells

↓

Prevents Oxidative and Free Radical Damage

↓

Maintains β-Cell Integrity & Function

↓

Sustains Insulin Productions
→ Supports Normal Glucose Homeostasis

**3. Anti-Inflammatory Effects of Blackberry**

Blackberry Bioactives
(Anthocyanins)

↓

↓ sppression of Inflammatory Mediators
(TNF-α, IL-6, NF-κB)

↓

↓ Inflammation in Peripheral Tissues
Reduced Insulin Resistances

↓

↑ Insulin Sensitivity
→ Fewer Diabetic Complications

**4. Regulation Lipid Metabolism by Blackberry**

Blackberry Bioactives
(Polyphenols, Ellagic Acid, Flavonoids)

↓

Improvement in Lipid Metabolism

↓

↓ LDL Cholesterol & Triglycerides

↓

↑ HD cholesterol

↓

Better Lipid Balance
↓ Risk of Metabolic Syndrome & Heart Complications
→ Supports Cardiovascular Health in Diabetic Patient

**Formulation of blackberry fruit:**

| Formulation Type | Description/ Example | Purpose |
|---|---|---|
| Herbal Tablets / Capsules | Contain standardized blackberry seed Extract | Easy administration and sustained release |
| Syrups / Juices | Aqueous extract-based preparations | Traditional use and pediatric |
| Polyherbal Formulations | Combined with herbs like Gymnema sylvestre or Momordica charantia | Synergistic hypoglycemic effe |

| | | |
|---|---|---|
| Nanoformulations | Blackberry extract-loaded nanoparticles / liposomes | Enhanced solubility, bioavailability |
| Functional Foods | Jam, yogurt, or nutraceutical beverages enriched with blackberry extract | Preventive and maintenance therapy |

**Application of blackberry**

1. Blackberries possess significant anticancer potential due to their rich antioxidant content. These antioxidants help neutralize free radicals that can damage cells and contribute to cancer development.
2. Additionally, blackberry consumption helps boost and protect the immune system, thereby reducing the overall risk of cancer.
3. The root of the blackberry plant has traditionally been a key ingredient in decoctions used for the treatment of dysentery and diarrhea.
4. Preparations from the blackberry bush have also been utilized to relieve whooping cough,
5. while blackberry juice is recommended for managing colitis.
6. A root-based tea has been employed to ease labor pain, and the leaves are sometimes chewed to alleviate toothache.
7. Moreover, the berries themselves serve as a potent source of natural antioxidants.

**Benefits of Blackberry in Diabetes**

1. Regulates blood glucose levels(17)
2. Improves lipid metabolism(18)
3. Enhances insulin sensitivity(17)
4. Provides antioxidant protection(18)
5. Supports cardiovascular health(17)
6. Reduces oxidative and inflammatory stress

## CONCLUSION

Blackberry (Rubus fruticosus) is a beneficial fruit with strong antidiabetic potential. It acts through antioxidant mechanisms, improving insulin sensitivity, and reducing .glucose levels. It can be used as a supportive therapy along with regular medication. Further research is recommended to explore its full potential in diabetes treatment.

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