



“A Comprehensive Review On The Botanical, Phytochemical And Pharmacological Importance Of Blackberries (Rubus Spp.)”

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❖ Abstract:-

Blackberries (Rubus spp.) are nutritionally rich fruits valued for their diverse phytochemical composition and broad therapeutic potential. This review summarizes current scientific evidence on their botanical characteristics, phytoconstituents, and pharmacological activities. Blackberries contain abundant phenolic acids, flavonoids, anthocyanins, vitamins, and dietary fibre, which contribute to their strong antioxidant, anti-inflammatory, antimicrobial, and cardio protective properties. Traditional uses of blackberry fruits, leaves, and roots include the management of digestive disorders, infections, and metabolic disturbances. Recent studies also highlight their potential applications in functional foods, nutraceuticals, and pharmaceutical formulations.

❖ Keywords:-

Rubus fruticosus, phytochemicals, antioxidant, anti-inflammatory, therapeutic uses, pharmacological activity.

• Introduction:-

Blackberries are edible fruits belonging to the genus Rubus, family Rosaceae, and are widely distributed across Europe, Asia, and North America.¹ Blackberries are members of the Rosaceae family's Rubus genus and subgenus (formerly Educates). Commercial cultivars are usually multispecies complexes without a species name. An estimated 154,578 tons of blackberries (Rubus sp.) are produced commercially worldwide each Year.² The primary regions for blackberry production are North America, Europe, Asia, South America, Oceania, Central America, and Africa (in descending order of tons cultivated).³

The fruit is made up of a collection of 1-3 cm-diameter droplets that, as they ripen, turn from green to crimson to black. The phenolic chemicals, primarily anthocyanins, flavonols, ellagitannins, and phenolic acids, have been found to be the most prevalent in blackberry extracts. Traditionally, the amount of phenolic chemicals in blackberry extracts has been directly linked to their bioactivity. The presence of anthocyanins (anthocyanidin glycosides) the primary class of flavonoids in berries and their primary bioactive component, determines the color of the blackberry fruit. Flavonoids and ellagitannins are additional phenolic compounds found in blackberries whose bioactivity has been documented by numerous in vitro assays.⁴

They are reasonably easy to grow in tiny spaces and produce lovely fruit in the spring, summer, and fall, blackberries are great fruit plants for home landscapes. Black berries are a fruit crop that works well for growers who wish to adhere to Earth-Kind Orchard and Small Fruit Crops production principles, despite the fact that they do have some difficult insect pests and diseases. Blackberries have a very high potential for output. The findings indicate that European blackberry plants are utilized for herbal therapeutic purposes, including as a good antioxidant, antibacterial, anticancer, antidiarrhea, antidiabetic, and antidiarrhea.⁵



Fig.no1. Black berries

Whooping cough has been treated with blackberry bush. For colitis, blackberry juice has been suggested. On the other hand, labor pain has been treated with a tea produced from the roots. Chewing blackberry leaves has been used to treat toothaches.⁶

The berry is a potent antioxidant. Because of their antioxidant qualities, phenolic compounds have been linked to health benefits, including protection against degenerative disorders. To comprehend the potential modes of action and their effects on human health, it is crucial to advance our understanding of their bioavailability.⁷ Although blackberries are available for fresh consumption, they are more frequently processed into juices, jams, purees, concentrates, and desserts. For consumers and the food industry, fruit quality is crucial. This includes both the fruit's exterior look and its internal quality, which is directly correlated with its primary and secondary metabolite content. Additionally, it is crucial to keep in mind that superior fruit is worth more on the market.⁸

Pharmacognosy:

-Biological Name: *Rubus fruticosus* L.Common

Name: Blackberry

Synonyms: *Rubus discolor*.

Family: Rosaceae Order: Rosales

Genus: *Rubus*

Species: *R. fruticosus* aggregate (complex hybrid group)

Biological Source: The fruit consists of the ripe aggregate berry obtained from the shrub *Rubus fruticosus* L., belonging to the family Rosaceae.

The biological source used in medicinal and nutritional studies includes the fresh or dried ripe fruits of *Rubus fruticosus* L., and occasionally the leaves and roots, which contain tannins, flavonoids, and phenolic acids with therapeutic potential.⁹

• Physicochemical Characteristics of Blackberry Fruits

Blackberry fruit size, firmness, total soluble solids (TSS), titratable acidity (TA), and total phenolic content (TPC) were used to describe the overall fruit chemistry. Every week, 10 randomly chosen fruits of U.S. No. 1 grade were measured for size using a digital Vernier caliper (Neiko 01407A, Taiwan). The same ten blackberries were used to test the hardness of the fruit using a GS-15 fruit texture analyzer (QA Supplies, Norfolk, VA, USA).¹⁰

• Berries with significant health-promoting properties

Berry fruit consumption has a significant and beneficial effect on human health, performance, and illness, according to an overwhelming amount of data.¹¹ These fruits include a variety of nutrients and bioactive substances, including vitamins A, C, and E, minerals (calcium, phosphorus, iron, magnesium, potassium, sodium, manganese, and copper), dietary fiber, and phenolics. This final subclass has been the subject of much research, primarily because of its remarkable antioxidant and anti-inflammatory qualities. Indeed, phenolics are thought to be the primary cause of the health advantages associated with these berries.

They are particularly noteworthy for their ability to lower inflammation, improve neurological function and strengthen the immune system, prevent cardiovascular diseases, and provide resistance against oxidative stress.¹² Anthocyanins make up between 5% and 10% of the dry weight of berries.¹³ Due to their beneficial effects on human health, small fruits with high anthocyanin content, like blackberries, are growing in popularity.¹⁴

Unbalanced redox homeostasis, sometimes referred to as oxidative stress, has been found to have a critical role in the genesis of noncommunicable diseases, such as cancer, type 2 diabetes, and cardiovascular disease.¹⁵

Berry chemicals have been demonstrated to prevent mutagenesis and cancer initiation through their capacity to scavenge ROS and lessen oxidative DNA damage, boost antioxidant enzymes, decrease carcinogen-induced DNA adduct formation, and improve DNA repair. Berry components also affect signaling pathways linked to cell proliferation, differentiation, apoptosis, and angiogenesis, among other biological processes linked to the development of cancer.¹⁶

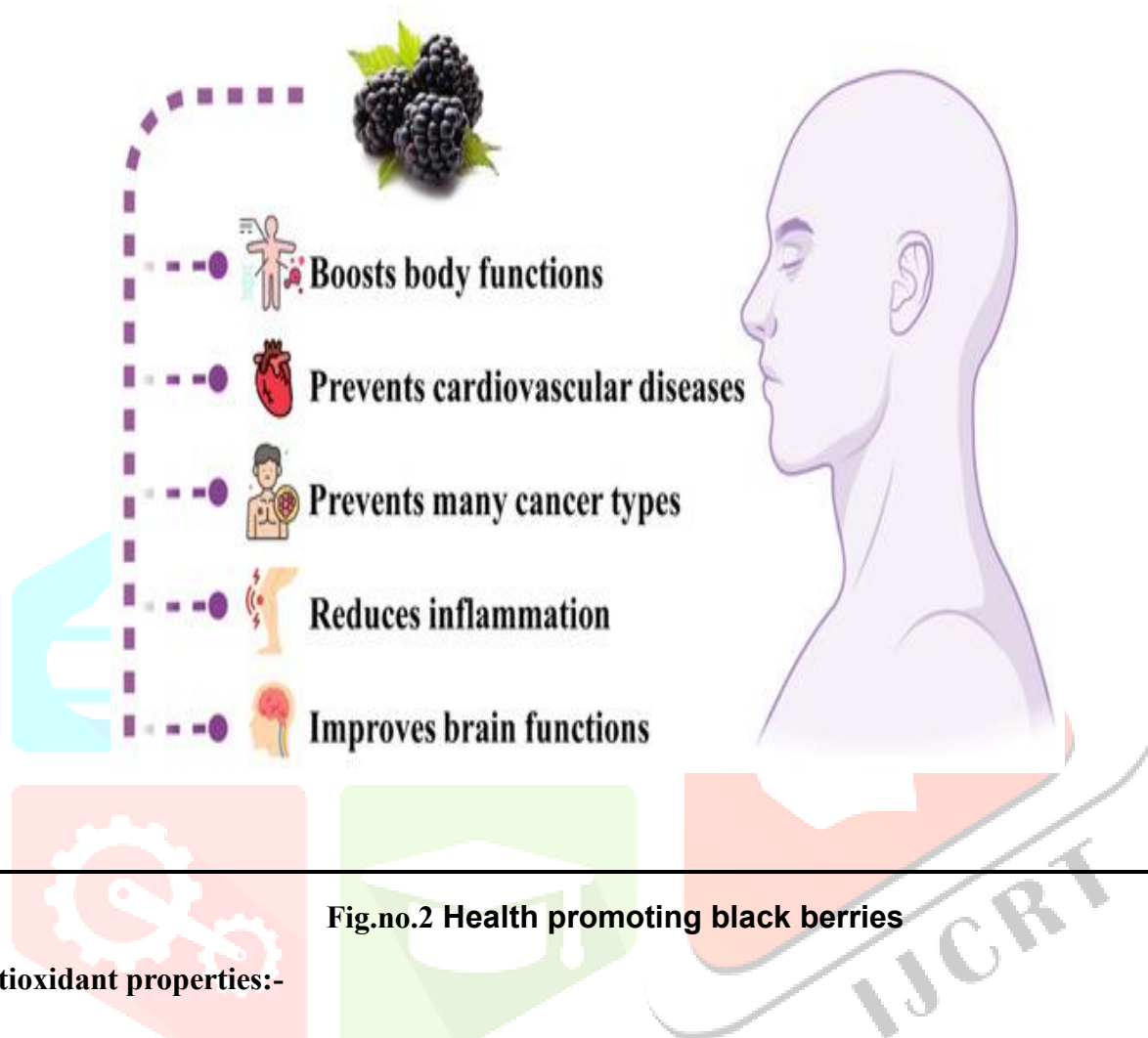


Fig.no.2 Health promoting black berries

Antioxidant properties:-

Concentrations of the extract that may be used as a natural pigment in functional meals have an impact on blackberries' antioxidant potential. The antioxidant capacity is not significantly influenced by ascorbic acid. Total polyphenols and TAC and/or total anthocyanins showed a significant association. There is a closer correlation between radical scavenging activity and total polyphenols than there is between radical scavenging activity and total anthocyanins. Consequently, anthocyanins and phenolics both have a significant impact on antioxidant activity.¹⁷

Diabetes:

Berries high in physiologically active phytochemicals, especially proanthocyanidins and anthocyanin, can treat diabetes and other metabolic illnesses and prevent blood glucose levels from rising. Limiting glucose absorption through the inhibition of α -amylase and α -glucosidase activity is the purported mechanism for reducing postprandial hyperglycemia. Limiting glucose absorption through the inhibition of α -amylase and α -glucosidase activity is the purported mechanism for reducing postprandial hyperglycemia. Red raspberry extracts are the most effective at inhibiting α -amylase when compared to other berry extracts.¹⁸

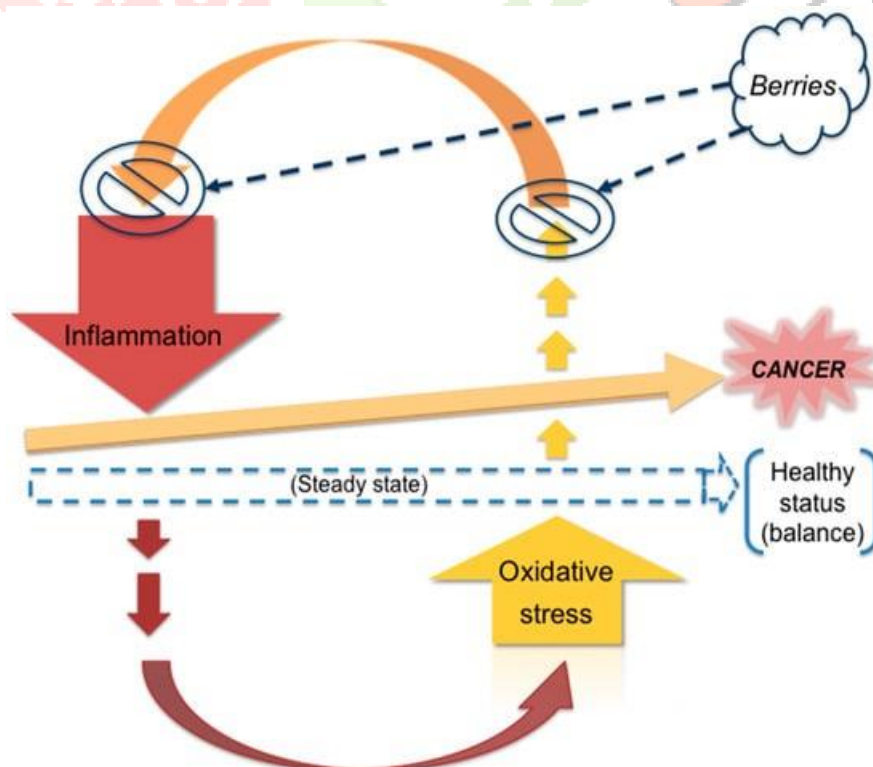
In the West, the prevalence of type 2 diabetes has almost reached epidemic levels. According to Hanhineva³⁶'s outline, berries can positively impact glycemic management in four primary areas:

1. Preventing oxidative stress and glucose-induced damage in pancreatic cells .
2. Inhibition of the absorption and digestion of starch.
3. inhibition of the liver's release of glucose .
4. Enhanced absorption of glucose in peripheral tissues, like muscles defense against oxidative stress and damage caused by glucose The pancreatic cells that release insulin become dysfunctional in the prediabetic state.¹⁹

Black berries used in the cancer:-

By affecting carcinogen metabolism, berries prevent tumor start events and lower levels of DNA damage caused by carcinogens. The growth of precancerous cells, encouraging apoptosis, lowering tissue inflammation parameters, and preventing angiogenesis, they prevent promotion/progression events. Berries affect the expression of genes related to angiogenesis, proliferation, apoptosis, and inflammation at the molecular level.²⁰

Tumorigenesis can result from long-term oxidative stress and inflammation, which can essentially tip the scales and cause a cell to change from a healthy to a malignant phenotype (Fig. 3). Reactive oxygen species (ROS) and/or reactive nitrogen species (RNS) can be produced as a result of oxidative stress caused by biological, chemical, and physical causes, either alone or in combination. Tissues are harmed by oxidative stress, which also triggers an immunological reaction that promotes inflammation as the body tries to repair the harm.²¹



Cancer development is strongly linked to oxidative stress. Blackberries neutralize free radicals by increasing antioxidant enzymes, reducing DNA mutation and cancer initiation. Oxidative stress damages DNA and triggers cancer development. Blackberries are rich in polyphenols that

Prevent DNA strand breaks

Enhance cellular repair enzymes

Protect against chemical carcinogens from polluted food, tobacco smoke, and UV radiation

Ellagitannins and anthocyanins bind to free radicals, reducing genotoxicity and restoring DNA integrity.

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