

## EXPLORING THE WORLD OF RASPBERRY: CULTIVATION, CLASSIFICATION, NUTRITIONAL BENEFITS, AND VERSATILE APPLICATIONS

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### ABSTRACT

The purpose of this paper is to study the scientific classification of raspberries. The raspberries are cultivated in abroad as well as in Pakistan. Raspberry is a crop that is cultivated in most European countries and in different areas of Pakistan such as Murree, Islamabad, and Lahore. Raspberries are an excellent source of vitamin C and fiber. Antioxidants are present in raspberries which may prevent cell damage and cancer. Raspberries are used to lower the sugar level. We use raspberries in different products such as juices, lotions, desserts, and wines. There are many health benefits of raspberries for humans as well as animals in lowering sugar levels and prevent from cancer and other cell damage. Raspberries (*Rubus idaeus* L.) are renowned for their sensory and nutritional properties, owing to their high level of critical components that are useful for the role of biological activity in human health. Raspberries are one example of a plant-based diet that appears to lower the risk of obesity, diabetes, heart disease, and death. It may support the promotion of a vibrant complexion, increased vitality, and weight loss.

**Keywords:** Antioxidants, Sensory, Nutritional, Complexion.

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### INTRODUCTION

Raspberries are perennial plants with canes that are 2 years old. Most canes only bear fruit in their second year and are either smooth or loaded with prickles. Depending on the species or cultivar, the canes can reach a height of more than 1.8 m (6 feet) and contain compound leaves with three or more toothed leaflets (Schulz and Chim, 2019). The backsides of the leaves are often hairy and range in color from white to gray. The white to pink five-petaled blooms give rise to delectable scarlet, purple, or black (rarely orange, amber, or pale yellow) fruits. Unlike blackberries, the fragile fruit's center remains on the vine when harvested (Lopez-Corona *et al.*, 2022). Although they are usually referred to as "berries," the fruit is actually an aggregate of drupelets (little drupes). These substances have great medical potential and are valuable to humans as food sources and cosmetic additions. The raspberry seed oil has numerous pharmacological properties, including antibacterial, antioxidant, and anti-inflammatory action, among others (Ispiryan *et al.*, 2021).

### HISTORY OF RASPBERRY

Raspberries are indigenous to Asia Minor and were reportedly gathered on Mount Ida foothills by the people of Turkey (Troy) in first century BC with recorded domestication in 14<sup>th</sup> Century by Roman agriculturist Palladius (Totic, 2014).

### CLASSIFICATION

The scientific name for raspberry is *Rubus*, and it is a member of the Rosaceae family and subfamily Rosoideae. Raspberry is one of the most varied plants in the plant kingdom (Cosme *et al.*, 2022). It can be challenging to separate members of the genus into distinct species for a variety of reasons, such as interspecific hybridization and apomixis. Members of these domesticated subgenera include flowering raspberries, blackberries, arctic fruits, and raspberries. They have all been employed in breeding projects. The European red raspberry (*Rubus idaeus* L. subsp. *idaeus*) (Fig. 1a), *R. idaeus* subsp. *strigosus* Michx, and the black raspberry (*Rubus occidentalis* L.) (Fig. 1b) are the three most notable varieties of raspberries (Drobek *et al.*, 2019). *Idaeobatus*, a member of the *Rubus* subgenus, is mostly found in Asia, although it is also present in Europe, North America, East and South Africa. The subgenus *Eubatus*, on

the other hand, is primarily found in South America, Europe, and North America (Jennings and Brennan, 2001).

### CULTIVATION OF RASPBERRIES IN ABROAD

Nearly half of the world's production of (*R. idaeus* L.) is thought to be produced in Europe. In many European nations, this significant high-value horticulture sector supports employment both directly in agriculture and indirectly in the food processing and confectionery industries (Emwas *et al.*, 2021). Northern and western regions produce the majority of the raspberries. Although there is a growing trend toward cane fruit cultivation in southern European nations such as Greece, Italy, Portugal, and Spain. In many fruit-producing regions, fruit is frequently farmed for the fresh market, but in central Europe, especially Poland, Hungary, and Serbia, a considerable portion of the harvest is used for processing (Derrick *et al.*, 2019). Important production hubs in North America include the Pacific Northwest, California, Texas, and Arkansas, as well as parts of New York, Michigan, Pennsylvania, and Ohio. Sales of raspberries grown using "organic production" techniques, such as crop rotation and the avoidance of pesticides (except those currently approved by the national regulatory body for organic farming), have increased, particularly in Europe (Piasecka *et al.*, 2022). However, maintaining productive plantations of woody perennial crops over a long period presents considerable obstacles, and it is still too early to evaluate the overall success of these *Rubus* cane fruit operations. The production season, as well as the length of various foliar and cane pests' attacks, has been prolonged by the rising popularity of autumn-fruiting raspberries (Jennings and Brennan, 2001; Meesters and Pitsioudis, 1993), in which late-season fruit is obtained from berries ripening on the higher nodes of primocanes. Primocane-fruiting raspberries are typically grown in warmer climates in Europe, where early-October frost risks are low, and fall temperatures are generally rather high. Interest in extended-season production under glass or plastic structures has also been reported in northern European countries like Belgium, the United Kingdom, and now Mediterranean periphery countries such as Spain and Greece (Barry, 1995). This trend will have an impact on these nations' pest and disease status. Before being planted in late spring for a late summer harvest, lengthy primocanes from northern places, like



Fig. 1: (a) Red Raspberries (Britannica, 2020). (b) Black Raspberries (Maughan et al., 2018)

Table 1: Nutritional aspects of the red raspberries

Constituent	Amount per 100 g of fresh fruit
Water (percent)	84.2
Calories	57
Carbohydrate	13.6 g
Fiber	6.5 g
Calcium	22 mg
Magnesium	22 mg
Phosphorus	22 mg
Potassium	168 mg
Vitamin A	130 international units
Ascorbic acid (Vitamin C)	25 mg
Thiamine (Vitamin B1)	0.03 mg
Total anthocyanins <sup>3</sup> (cyanidin 3-glucoside equivalent)	65 mg
Total phenolics (gallic acid equivalent)	517 mg
Antioxidant capacity <sup>1</sup> (ORAC, Trolox equivalent)	2400 pmol
Protein	1.2 g
Sodium	1 mg
Fat	0.5 g
Iron	0.9 mg
Niacin	0.9 mg
Riboflavin (Vitamin B2)	0.09 mg

Wada and Ou, 2002

Scotland, are cut off, frozen, and preserved for a long period. The idea of manufacturing during the off-season has become very well-liked (Higbee et al., 2022).

#### CULTIVATION OF RASPBERRIES IN PAKISTAN

Raspberries have been successfully grown near Malir despite being a cool-climate species. If this is the case, they might also be carefully grown elsewhere in Karachi (Azlan et al., 2022). They do grow and produce well in the areas surrounding Lahore, Rawalpindi/Islamabad, and Peshawar. They can also be found in odd places in the Murree Hills and in Nathia Gali, both in cultivation and growing wild. The plants, known as the "canes," are occasionally sold in Islamabad and online by a Lahore-based nursery (Rao et al., 2021).

#### NUTRITIONAL ASPECTS OF RASPBERRIES

Red raspberries provide a number of nutrients that are good for your health, including dietary fiber, fatty acids, and essential vitamins and minerals. In addition, a variety of polyphenolic phytochemicals, such

as flavonoids, phenolic acids, lignans, and tannins, are present in them. Raspberries have few calories overall, with only 52 calories per 100 g. Due to their high dietary fiber content (6.5 g/100 g), and high fructose content (>50% of total sugars), which both regulate blood sugar levels by delayed digestion, and sweet flavor, they make a delicious snack replacement for processed meals. The oil from raspberry seeds is a rich source of healthy, essential fats because it is 97.8% unsaturated and has a low n-6/n-3 fatty acid ratio of 1.64 (Parry et al., 2005). The flesh of the fruit has a high concentration of water-soluble vitamin C, with 26.2 mg/100 g of fresh fruit, while the seeds contain fat-soluble vitamins such as carotenoids and tocopherols. In addition, raspberries have trace amounts of calcium, zinc, thiamine, vitamin B6, riboflavin, vitamin A, and thiamine (Gätlan and Gutt, 2021). The nutritional aspect of raspberries is given in Table 1.

#### HEALTH BENEFITS OF RASPBERRIES IN HUMAN

Raspberries have significant levels of vitamin C, quercetin, and ellagic acid, three potent antioxidants. They include more than half of the recommended daily intake (RDI) for iron absorption as well as vitamin C, a water-soluble vitamin (Carr and Frei, 1999). Antioxidants found in plants help your cells protect themselves from oxidative damage and recuperate. The chance of developing diseases such as cancer, diabetes, heart disease, and others is raised by oxidative stress. Antioxidants found in abundance in raspberries help prevent cell damage and lower the chance of developing certain chronic diseases (Skrovankova et al., 2015). Raspberries are high in fiber and low in carbohydrates. Raspberries may improve insulin resistance and lower blood sugar. They are also unlikely to increase blood sugar levels. In addition, raspberries have a lot of tannins, which prevent alpha-amylase, an enzyme needed to break down starch; raspberries may limit the amount of carbohydrates absorbed after a meal by inhibiting alpha-amylase, which lessens the effect on your blood sugar. The strong antioxidant content of raspberries may prevent cancer such as colon, mouth, breast, and liver cancer (Seeram et al., 2006). Raspberries offer anti-inflammatory qualities that could lessen arthritic symptoms. Raspberries are rich in antioxidants, which can help combat free radicals in your body to delay the onset of aging. Additionally high in vitamin C, which is essential for wholesome skin, raspberries are. It might increase collagen synthesis and repair UV-induced skin damage (Souyoul et al., 2018). Raspberries aid in weight loss. Increasingly, cardiovascular disease is one of the world's major causes of mortality. Red raspberry's anti-oxidant properties proved useful in the treatment of cardiovascular disease. In addition to this, the favorable health component of red raspberry contributes to disease prevention (Zafra-stone et al., 2007). The anthocyanins in raspberry aid in improving endothelial function by protecting endothelial cells from oxidative stress (Mullen et al., 2002).

#### HEALTH BENEFITS OF RASPBERRIES IN ANIMALS

According to animal research, the anti-inflammatory and antioxidant qualities of raspberries and raspberry extracts may reduce the chance of developing chronic illnesses such as cancer, diabetes, heart disease, and obesity (Burton-Freeman et al., 2016). In an 8-week experiment, mice with diabetes and obesity who were fed freeze-dried red raspberries displayed lower levels of oxidative stress and inflammation than the control group (Noratto et al., 2016). Compared to the control group, mice given freeze-dried red raspberries along with a high-fat meal displayed lower blood sugar levels and decreased insulin resistance (Zhu et al., 2018; Chiu et al., 2018). Mice given raspberries also reported lower incidences of fatty liver disease. Ellagic acid, an antioxidant found in raspberries, may not only prevent oxidative damage but also repair damaged DNA, according to a second mice research (Aiyer et al., 2008). Animal experiments with raspberries show that they have cancer-fighting properties. Red raspberry berries were 5% of the diet for mice with colitis in a 10-week study. These mice showed reduced inflammation and had a lower risk of developing cancer than the control group (Bibi et al., 2018). Another study discovered that red raspberry extract prevented mice from developing liver tumors. Larger doses of raspberry extract reduced the likelihood of tumor growth (Liu et al., 2010).

## USES OF RASPBERRIES

Raspberry fruit is appealing to customers because of its pleasant aroma and color, low-calorie content, and high nutritious value, as well as health benefits manifested by high antioxidant levels (Alibabic et al., 2018). Raspberry fruits (*R. idaeus* L.) are a valuable berry crop for both the fresh and processed markets. Raspberry is a valuable commercial product in both fresh and processed form due to its nutritional, therapeutic, and cosmetic applications. The processed foods (juices, preserves, frozen foods, dessert wines, oils, lotions, and so on) industry frequently uses both black and red raspberries. Raspberries are farmed for both the fresh fruit market and industrial processing into individually fast-frozen (IQF) fruit, purée, juice, or dried fruit, which are utilized in a range of grocery store goods such as raspberry pie (Costa and Mafra, 2022). Raspberries require a lot of sunlight and moisture to grow properly. Red berries are pulpy fruits that are used to make a range of foods, including sauces, baked goods, snacks, drinks, and nutraceuticals to enhance the flavors of dairy food products such as shakes and flavored ice cream (Sabbadini et al., 2021).

## MEDICINAL USES

Blackberry leaves have conventionally been utilized in herbal medicine as an antibacterial agent as well as for their antioxidant effects (Martini et al., 2009). Blackberry leaves and roots have long been used as a home cure for anemia, menstrual irregularities, diarrhea, and dysentery. The fruit and juice are used to treat anemia. A normal infusion, which can also be used externally as a lotion, has been found to heal psoriasis and scaly skin disorders. Blackberries are also utilized in the production of wine, brandy, and flavoring liqueurs, and cordials (Dziki, 2021).

## TRADITIONAL USES

Infusions of the plant are used to treat diarrhea since it is highly astringent. It is used as a mouthwash to strengthen spongy gums and relieve mouth ulcers. The berries provide a nice gurgle when swallowed. External wounds and bruises are treated with poultices or compresses. Decoctions are remedies for diarrhea and hemorrhoids. The tannins in the plant not only tighten the tissue but also aid in the control of mild bleeding (Verma et al., 2014).

## CONCLUSION

Thus, raspberries are of the highest value because they are rich source vitamin C, fibers, antioxidants, and other minerals. Raspberries are cultivated mostly in European countries. Recent studies show that raspberries are highly cultivated in Russia. In Pakistan, raspberries are cultivated in different cities such as Murree, Islamabad, and Lahore. Raspberries are rich source of antioxidants which provide the useful component to our daily diet. Raspberries are unique among berries due to their optimal nutritional composition of minimal fat calories and a good source of vitamin C, antioxidants, and fibers. Studies show that raspberries may help to prevent cancer, lowering of blood cholesterol levels, prevent from arthritis and other diseases. Raspberries are used in cosmetics, and pharmaceutical industries for medicinal purposes because of their antimicrobial, antioxidant, and anti-inflammatory properties.

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