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A comprehensive review on edible flowers: Phytochemical profile and its food application

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Abstract

Edible flowers are gaining popularity as a novel food ingredient due to their unique taste, aroma, and health-promoting properties. In this paper, we review the phytochemical profile of commonly used edible flowers, including their antioxidant, anti-inflammatory, and anticancer properties. Edible flowers are rich in various bioactive compounds, such as flavonoids, phenolic acids, and carotenoids, which contribute to their health benefits. We also explore the food applications of edible flowers in various food products, including baked goods, beverages, confectionery, and savory dishes. Edible flowers not only add flavor, color, and texture to food products, but they also offer functional benefits as natural food additives. The use of edible flowers in the food industry is a growing trend, and it offers new opportunities for innovation and sustainability. However, proper identification and safe sourcing of edible flowers are essential to ensure their safety for human consumption. This review provides valuable insights into the phytochemical profile and food applications of edible flowers, highlighting their potential as a functional food ingredient for promoting human health and well-being.

Keywords: Edible, flowers, phytochemical, food, bioactive

Introduction

Edible flowers have been used for culinary and medicinal purposes for centuries (Mulik *et al.* 2020) [7]. The use of flowers in food has been gaining popularity in recent years due to their unique flavors, vibrant colors, and health benefits. Flowers are rich in antioxidants, vitamins, and minerals, making them an attractive ingredient for the food industry (Chamorro *et al.* 2022) [1]. This review paper aims to explore the use of edible flowers in food industries, their health benefits, and their potential as a functional food ingredient. Edible flowers are a culinary trend that has been gaining popularity in recent years. They have been used for centuries for their unique flavors, vibrant colors, and health benefits. Edible flowers can be used in various ways, such as a garnish to add a pop of color to dishes, as an ingredient in baked goods, salads, and beverages, or even as a functional food ingredient due to their health benefits (Pires *et al.* 2019) [9]. With their wide range of flavors and textures, edible flowers offer a creative and unique way to add visual appeal and flavor to food products. In this introduction, we will explore the history, benefits, and applications of edible flowers in the culinary world.

Edible flowers of India

In India, the use of edible flowers in cuisine dates back to ancient times. Edible flowers have been an integral part of Indian culinary traditions and are used in a wide range of dishes, from savory to sweet. Flowers such as marigold, rose, jasmine, hibiscus, and banana blossom are commonly used in Indian cuisine. One popular use of edible flowers in India is in the preparation of traditional sweets and desserts. For example, rose petals are used to flavor milk-based sweets like ras malai and kulfi, while marigold flowers are used in the preparation of traditional ladoos. In addition to their culinary use, edible flowers are also used in traditional Indian medicine. Ayurveda, the ancient Indian system of medicine, recognizes the medicinal properties of many flowers and uses them to treat various ailments.

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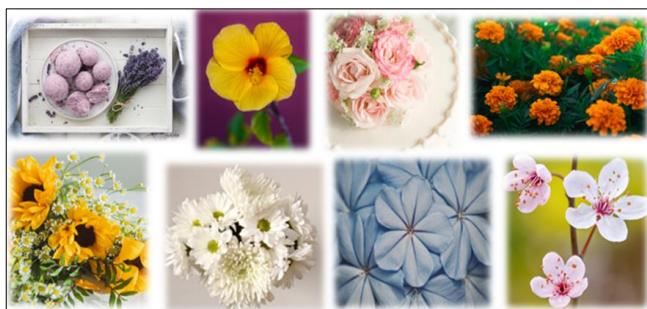


Fig 1: Figure showing images of some edible flowers

With the growing interest in natural and healthy ingredients, the use of edible flowers in Indian cuisine is gaining popularity (Takahashi *et al.* 2020) ^[11]. Edible flower-based products, such as tea blends and flavored syrups, are also becoming more widely available in India. The use of edible flowers in Indian cuisine not only adds a unique and flavorful touch to dishes but also offers potential health benefits.

Edible flowers are consumed in different parts of India, where they are used in a variety of dishes and preparations. Here are some examples:

1. Marigold flowers (also known as genda phool) are widely used in North India, particularly in Rajasthan and Punjab. They are used in the preparation of traditional sweets like ladoos and barfis, as well as in savory dishes like pakoras and chaat.
2. Hibiscus flowers (also known as gudhal or shoe flower) are commonly used in South India, where they are used to prepare a popular drink called hibiscus tea. The flowers are also used in curries, chutneys, and as a natural food colorant.
3. Banana blossom (also known as kele ka phool) is a popular ingredient in South Indian cuisine, particularly in Kerala and Tamil Nadu. It is used to prepare a variety of dishes, including stir-fries, curries, and salads.
4. Rose petals are used throughout India, particularly in the preparation of milk-based sweets like ras malai and kulfi. They are also used to flavor desserts, teas, and syrups.
5. Jasmine flowers (also known as mogra) are commonly

used in North India, particularly in Uttar Pradesh and Bihar. They are used to flavor tea and desserts like kheer and phirni.

Overall, edible flowers are consumed in different parts of India, where they are appreciated for their unique flavors and aromas, as well as their potential health benefits.

Types of Edible Flowers

There are numerous types of edible flowers that are commonly used in the food industry, including rose, lavender, hibiscus, elderflower, marigold, dandelion, and nasturtium, among others. Each flower has a unique flavor and aroma profile that can enhance the taste and appearance of dishes (Kim *et al.* 2015). For example, rose petals have a sweet and fragrant taste, while lavender has a subtle floral flavor with a hint of sweetness.

There are many types of edible flowers available, each with its unique flavor and culinary uses. Here are some examples

1. **Rose:** Sweet, floral flavor; commonly used in desserts, teas, and syrups.
2. **Lavender:** Floral, slightly sweet flavor; commonly used in baked goods, teas, and cocktails.
3. **Hibiscus:** Tart, fruity flavor; commonly used in tea, syrups, and cocktails.
4. **Marigold:** Slightly bitter, earthy flavor; commonly used in sweets, Savory dishes, and tea.
5. **Chamomile:** Sweet, apple-like flavor; commonly used in tea, baked goods, and cocktails.
6. **Nasturtium:** Peppery, slightly bitter flavor; commonly used in salads, sandwiches, and as a garnish.
7. **Elderflower:** Floral, sweet flavor; commonly used in syrups, cocktails, and baked goods.
8. **Chrysanthemum:** Slightly bitter, grassy flavor; commonly used in tea, salads, and stir-fries.
9. **Jasmine:** Sweet, floral flavor; commonly used in tea, desserts, and aromatherapy.
10. **Pansy:** Mild, slightly grassy flavor; commonly used in salads, desserts, and as a garnish.

Table 1: Different types of edible flowers

Edible Flower	Flavor Profile	Color	Common Culinary Uses
Rose	Sweet, floral	Red, pink, white, yellow	Desserts, tea, syrups
Lavender	Floral, slightly sweet	Purple	Baked goods, tea, cocktails
Hibiscus	Tart, fruity	Red, pink, white	Tea, syrups, cocktails
Marigold	Slightly bitter, earthy	Orange, yellow	Sweets, savory dishes, tea
Chamomile	Sweet, apple-like	White, yellow	Tea, baked goods, cocktails
Nasturtium	Peppery, slightly bitter	Orange, yellow, red	Salads, sandwiches, garnish
Elderflower	Floral, sweet	White	Syrups, cocktails, baked goods
Chrysanthemum	Slightly bitter, grassy	Yellow, white, pink	Tea, salads, stir-fries
Jasmine	Sweet, floral	White, yellow	Tea, desserts, aromatherapy
Pansy	Mild, slightly grassy	Purple, yellow, white	Salads, desserts, garnish

Health Benefits

Edible flowers have been used for medicinal purposes for centuries due to their health benefits. For instance, chamomile flowers are used to aid digestion, reduce inflammation, and improve sleep quality. Elderflower is used to relieve cold and

flu symptoms, while calendula is used to promote wound healing. Additionally, many edible flowers are rich in antioxidants, which can help prevent cell damage caused by free radicals.

Table 2: Bioactive profile and health benefits of edible flowers

Edible Flower	Bioactive Compounds	Health Benefits
Roses	Flavonoids, carotenoids, tannins, and phenolic acids	Antioxidant, anti-inflammatory, and antitumor properties
Lavender	Linalool, linalyl acetate, and rosmarinic acid	Calming and relaxing effects, antioxidant and anti-inflammatory properties
Hibiscus	Anthocyanins, flavonoids, and polysaccharides	Antioxidant, anti-inflammatory, and blood pressure-lowering properties
Marigold	Lutein, zeaxanthin, and carotenoids	Antioxidant and anti-inflammatory properties, potential to reduce the risk of age-related macular degeneration
Chamomile	Apigenin, quercetin, and phenolic acids	Anti-inflammatory, antioxidant, and antispasmodic properties, potential to improve sleep quality and digestive health
Nasturtium	Phenolic acids, flavonoids, and carotenoids	Antioxidant and anti-inflammatory properties, potential to improve respiratory and digestive health
Elderflower	Flavonoids, phenolic acids, and triterpenes	Antioxidant, anti-inflammatory, and antiviral properties
Chrysanthemum	Flavonoids, phenolic acids, and triterpenoids	Anti-inflammatory, antioxidant, and potential to improve cognitive function
Jasmine	Essential oils, phenolic acids, and flavonoids	Antioxidant and anti-inflammatory properties, potential to reduce stress and improve mood
Pansies	Anthocyanins, flavonoids, and carotenoids	Antioxidant and anti-inflammatory properties

Edible flowers not only add beauty and flavor to dishes but can also offer several potential health benefits. Here are some of the benefits associated with consuming edible flowers:

- 1. Antioxidant properties:** Many edible flowers contain high levels of antioxidants, which can help protect the body against free radicals and oxidative stress. For example, marigold flowers contain antioxidants like lutein and zeaxanthin, which may help protect against age-related macular degeneration.
- 2. Anti-inflammatory properties:** Some edible flowers, such as chamomile and lavender, contain anti-inflammatory compounds that may help reduce inflammation in the body.
- 3. Digestive benefits:** Certain edible flowers, such as hibiscus and calendula, have traditionally been used to

support digestive health. For example, hibiscus tea is believed to help reduce bloating and aid digestion.

- 4. Immune system support:** Edible flowers like elderflower contain compounds that may help boost the immune system and reduce the duration of cold and flu symptoms.
- 5. Relaxation and stress relief:** Certain edible flowers, such as lavender and chamomile, have calming properties that can help promote relaxation and reduce stress and anxiety.
- 6. Nutritional value:** Edible flowers can be a good source of vitamins and minerals, such as vitamin C and potassium. For example, nasturtium flowers contain high levels of vitamin C

Table 3: Health benefits of different edible flowers (Lu *et al.* 2016)

Edible Flower	Health Benefits
Rose	Rich in antioxidants and vitamin C; anti-inflammatory properties.
Lavender	Calming and relaxing properties; may aid in digestion and relieve headaches.
Hibiscus	May help lower blood pressure and improve heart health; rich in antioxidants.
Marigold	Anti-inflammatory properties; may improve skin health and wound healing.
Chamomile	Calming and soothing properties; may aid in digestion and relieve anxiety.
Nasturtium	Rich in vitamin C and iron; may boost immune system and improve respiratory health.
Elderflower	May have antiviral and anti-inflammatory properties; may improve digestion and relieve cold and flu symptoms.
Chrysanthemum	May help lower blood pressure and reduce inflammation; may improve eye health.
Jasmine	Calming and soothing properties; may improve mood and reduce stress.
Pansy	Rich in antioxidants and vitamin C; may have anti-inflammatory properties and aid in digestion.

Applications of edible flowers in Food Industries

Edible flowers have a wide range of applications in the food industry (Shantamma *et al.* 2021) [10]. They can be used as a garnish to add a pop of color to dishes or as an ingredient in baked goods, salads, and beverages. For instance, hibiscus flowers are commonly used to make teas, while rose petals are used to make jams, jellies, and syrups (Neetam *et al.* 2021) [8]. Edible flowers can also be used to infuse oils, vinegars, and spirits with their unique flavors and aromas. Edible flowers have become increasingly popular in the food industry for their unique flavor, color, and visual appeal. Here are some common applications of edible flowers in food industries:

- 1. Baked goods:** Edible flowers can be used to decorate cakes, cupcakes, and other desserts, adding a pop of color and enhancing the visual appeal of the product.
- 2. Beverages:** Edible flowers can be used to infuse tea, cocktails, and other beverages, adding a delicate floral flavor and aroma.
- 3. Salads and garnishes:** Edible flowers such as pansies, nasturtiums, and chrysanthemums can be used to add color and visual interest to salads, sandwiches, and other dishes.
- 4. Confectionery:** Edible flowers can be candied and used as a decorative element in sweets and confectionery, adding a touch of elegance and sophistication.

5. **Jams and preserves:** Edible flowers such as rose petals and lavender can be used to add flavor and aroma to jams and preserves.
6. **Ice cream and sorbet:** Edible flowers can be used to infuse ice cream and sorbet with delicate floral flavors, creating unique and innovative desserts.
7. **Oils and vinegars:** Edible flowers can be used to infuse oils and vinegars, adding a subtle floral flavor and aroma to dressings and marinades.

8. **Ethnic cuisine:** Edible flowers are used in traditional Indian, Thai, and Mexican cuisines, adding flavor and color to dishes such as curries, stir-fries, and tacos.

Overall, edible flowers offer a versatile and creative ingredient that can be used in a wide range of culinary applications, adding flavor, color, and visual interest to dishes and beverages.

Table 4: Applications of edible flowers in Food Industries (Chen *et al.* 2021) ^[10]

Edible Flower	Application in Food Industries
Rose	Flavoring agent in desserts, beverages, and confectionery; used in rosewater, syrups, and jams.
Lavender	Flavoring agent in baked goods, confectionery, and beverages; used in tea blends, syrups, and oils.
Hibiscus	Used as a natural food coloring agent; flavoring agent in tea, beverages, and desserts.
Marigold	Used as a natural food coloring agent; garnish for soups, salads, and pasta dishes.
Chamomile	Flavoring agent in tea blends, baked goods, and confectionery; used in oils and extracts.
Nasturtium	Garnish for salads, soups, and sandwiches; flavoring agent in spreads and dressings.
Elderflower	Flavoring agent in beverages, baked goods, and confectionery; used in syrups, jams, and liqueurs.
Chrysanthemum	Flavoring agent in tea blends, soups, and stir-fries; used in oils and extracts.
Jasmine	Flavoring agent in tea blends, desserts, and confectionery; used in essential oils and extracts.
Pansy	Garnish for salads, desserts, and beverages; used as a natural food coloring agent.

Functional Food Ingredient

Edible flowers have the potential to be a functional food ingredient due to their health benefits (Kumari *et al.* 2021) ^[5]. They can be used to add flavor, color, and nutrients to food products. For instance, incorporating elderflower into a beverage can provide anti-inflammatory and immune-boosting properties, while using calendula in a skin cream can promote wound healing and reduce inflammation.

Edible flowers are not only used for their aesthetic value but also as functional food ingredients due to their potential health benefits. They contain a variety of bioactive compounds such as antioxidants, flavonoids, and phenolic acids that have been shown to have positive effects on human health.

Some studies have shown that edible flowers may have antimicrobial, anti-inflammatory, and anti-cancer properties (Zheng *et al.* 2021) ^[12]. For example, marigold flowers contain lutein and zeaxanthin, which are known to have antioxidant properties and may help reduce the risk of age-related macular degeneration. Hibiscus flowers contain anthocyanins, which may help lower blood pressure and improve heart health. Elderflowers contain flavonoids that may have antiviral and anti-inflammatory properties.

In addition to their potential health benefits, edible flowers can also enhance the flavor and appearance of food products. They can be used as natural colorants, flavoring agents, and garnishes. For example, lavender flowers can be used to add a subtle floral flavor to baked goods, and rose petals can be used to make fragrant syrups and jams.

Overall, the use of edible flowers as functional food ingredients is a growing trend in the food industry. However, it is important to note that not all flowers are safe for consumption, and it is essential to properly identify and source edible flowers from reputable suppliers.

Conclusion and Future Scope

Edible flowers are a versatile and nutritious ingredient that can enhance the flavor, appearance, and health benefits of food products. They have a long history of use in culinary and

medicinal practices and are gaining popularity in the food industry. As a functional food ingredient, edible flowers have the potential to provide numerous health benefits and add value to food products (Gostin *et al.* 2019) ^[3]. Therefore, further research is needed to explore their potential applications in the food industry.

The use of edible flowers in food is a rapidly growing trend and has a bright future in the food industry. Here are some potential future developments:

1. **New applications:** As research continues to uncover the health benefits of edible flowers, there will likely be new applications of these ingredients in functional foods and nutraceuticals. For example, edible flowers may be used in supplements, powders, and capsules.
2. **Innovative culinary uses:** Chefs and food scientists are constantly experimenting with new culinary uses for edible flowers, such as incorporating them into savory dishes and creating new flavor combinations.
3. **Increased demand for natural ingredients:** As consumers become more health-conscious and concerned about the environmental impact of food production, there will likely be an increased demand for natural and sustainable ingredients like edible flowers.
4. **Development of new varieties:** There is potential for plant breeders to develop new varieties of edible flowers with unique flavors and nutritional profiles, specifically designed for use in the food industry.
5. **Exploration of traditional uses:** Edible flowers have been used in traditional medicine and culinary practices in various cultures for centuries. As interest in traditional and indigenous knowledge grows, there may be a renewed interest in these traditional uses of edible flowers.

Overall, the future looks bright for the use of edible flowers in food. With their unique flavors, nutritional benefits, and potential health properties, edible flowers are likely to become even more popular in the food industry in the coming years.

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