EDIBLE FLOWERS: BLOOMING DELICACIES FOR HEALTH AND WEALTH

Abstract

Because of their distinct flavour, scent, and nutritional advantages, edible flowers are becoming more and more popular. For thousands of years, they have been utilised in Middle Eastern, European, and Asian cuisines. Edible flowers are not only aesthetically pleasing but also rich in antioxidants, vitamins, and minerals, making them a healthy and natural addition to the diet. This article explores the history, benefits, and culinary uses of edible flowers, with a focus on Indian traditional practices. It also provides information on harvesting, storage, and potential risks associated with consuming certain flowers. As the demand for natural and healthful foods grows, edible flowers are becoming an increasingly important and innovative ingredient in the culinary world. However, caution should be exercised in identifying and consuming only edible varieties, as some flowers can be toxic or harmful. Through continued research and understanding, edible flowers can be integrated into various cuisines and contribute to the promotion of healthier and more sustainable food practices.

Keywords: Floriphagia; antioxidants; culinary; storage; harvest

Authors

Rajendran Gokiladevi
Ph.D. Scholar
Department of Horticulture,
Central University of Tamil Nadu
Thiruvarur, India.
rsggoki2828@gmail.com

Karuppiah Varsini
M.Sc. Horticulture
Department of Horticulture,
Central University of Tamil Nadu
Thiruvarur, India.

Khadar Batcha Shafrin Fathima
M.Sc. Horticulture
Department of Horticulture
Central University of Tamil Nadu,
Thiruvarur, India.

Rajakkannu Nithya
Ph.D. Scholar
Department of Horticulture
Central University of Tamil Nadu
Thiruvarur, India.

I. INTRODUCTION

Flowers are cultivated mostly for their economic and ornamental value; whereas some flowers are traditionally used as medicine, cosmetics and in culinary. These flowers which are taken for consumption are known as Edible flowers. The recent growing demand for natural, healthful foods has increased awareness of unusual or untried components like edible flowers [8]. Asian, European, and Middle Eastern cuisines all include flowers in their recipes. Eating edible flowers (EF) as salads or dishes or inhaling their perfume in a beverage or cuisine that has them as an ingredient can also give a feeling of fulfillment. They are now being exploited in the food industries as an alternative to the synthetic anti-oxidants as they are rich source of anti-oxidants. Instead of vitamins and supplements, the people who are worried about their health prefer raw or less-processed alternatives (such as dried rose petals or powdered saffron). Nutrients like vitamin A, C, riboflavin, niacin, and minerals can be found in edible flowers [4]. Flowers with bitter or astringent taste like lavender should be used sparingly to achieve correct garnish proportion. The same flower grown in different locations can taste different. They also add a beautiful color and flavor to dishes. They are a great source of vitamins and minerals. They can be added to salads, soups, stews, and desserts making the dish more attractive and flavourful.

II. HISTORY OF EDIBLE FLOWERS

The current practice of eating flowers has long been practiced by various cultures [8]. In addition to being utilized in traditional celebrations, dinner parties, traditional events, and natural health, edible flowers have been employed in Asian, European, Indian, Middle Eastern, and other cuisines.

Cooking with flowers dates back thousands of years; the earliest recorded use is around 140 B.C. Dandelions were among the bitter herbs described in the Old Testament's legal documents. Many different cultures have incorporated flowers into their traditional cuisines. Roman cuisine used edible pink, violet, and rose blossoms, while sauces contained lavender. Cooks and gardeners first used orange blossom and pot marigolds in cooking over a thousand years ago.

Day lily buds are used in Asian cuisine, and the Romans employed mallow, rose, and violets in their cusions. Stuffed squash blossoms originated in Italian and Hispanic cultures, while Ancient Indian traditions frequently employed rose petals in their cooking. Carnation petals are one of the traditional green liqueur Chartreuse,'s hidden components. It was created in France in the 17th century.

Ancient cultures used edible flowers as a flavour ingredient in food preparation and to embellish meals. Rosa *spp*. petals were employed in ancient Rome to sweeten and taste omelets, purees, beverages, and sweets. The flower petals of the *Calendula officinalis* plant were frequently added to salads in France throughout the Middle Ages. *Viola odorata* was utilized in colourful syrups, candies, and other beverages during the 17th century. *Sambucus nigra* and *Taraxacum officinale* flowers were widely used in Central Europe as breaded flowers that were boiled with sugar in place of honey [22]. Inflorescence bracts of the artichoke (*Cynara scolymus*), the inflorescence of the cauliflower (*Brassica oleracea var. Botrytis*), and the flower stalks with closed buds of broccoli (*Brassica oleracea var. Italica*).

End of the 20th and beginning of the 21st centuries saw a movement towards appreciating wild varieties, especially native species, which started to be commended by the media and employed as ingredients in cooking shows, periodicals, blogs, and cookbooks. One of them is edible flowers, which is utilised both as an aesthetic element and as an ingredient in recipes, so broadening its appeal to the general public. However, it was still not a widely consumed good everywhere.

There is a chapter about edible flowers in the book "Botanicals with Benefits: Develop a New Relationship with Your Garden: the Edible Flower Volume"[14].Marigold, Cosmos, Coral Vine, and Bougainvillaea flowers are frequently used in salads and floral teas by the locals of Northern Thailand [15]. 'Floriphagia' is defined as the consumption of fresh, recently chosen flowers with nutritional qualities or with some therapeutic and sensory activity related to their appearance or flavour [16].

Utiliization of edible flowers in Mexico, in their traditional cooking is very popular, due to their potential benefits and is considerbed as Cultural traits. Flowers have been associated with a variety of symbolizes in ceramics, sculpture, pyramids, and cave art from Mexico and Egypt. As a result of Spanish invasion, flowers started to replace meat in the diet due to Catholic Church rites associated with Easter celebrations. American coral tree, marigold, red frangipani, prickly pear, *Ferocactus species*, *Dhalia species*, *Cucurbita species*, *Yucca species*, *bilberry cactus, Agave species*, poinsettia, and runner bean are some of the most revered and cultivated species in Mexico. Before the Spanish settlers arrived, there were preconceptions against flower consumption, which was associated with destitution and is now frowned upon in the area [21]. As a result of traditions brought by European and Asian immigration, some flowers (including those from medicinal plants, pumpkin, broccoli, cauliflower, banana inflorescence bracts, and artichokes) were include in Brazillian food. Some of the most popular edible flowers in the world are shown in Figure 1.

III. BENEFITS OF EDIBLE FLOWERS

It is quite significant that flowers are frequently utilised medicinally in addition to being consumed for their flavour. Nectar and pollen are abundant in flowers, and studies have shown that pollen is particularly rich in vitamins and minerals. Since flowers are made up of 95% water, they should be very nutrient-dense. Blooms don't contain calories, but they do have a lovely appearance, a pleasant aroma, and a delicious taste. The few reviews that are available claim that they are almost calorie-free. The majority of edible flowers, such Flower of Night Jasmine, Phlogacanthus *spp*., etc., have a bitter flavour. These are suggested to prevent stomach issues such as t stomach upset, appetite loss, jaundice, liver issues, cold and cough, and polygenic illnesses. The beauty and health benefits of edible flowers represent a niche sector. The food business is a well-established sector of the economy. Including edible flowers in foods, beverages, and desserts may be a way to distinguish items and enhance customer service. Phytochemicals found in edible flowers include antioxidants, anti-inflammatories, cancer- and obesity-fighting agents, hypoglycemic agents, and substances that protect the neurological, hepatic, and digestive systems [8]. The hues of fruits and vegetables, as well as the colours of flowers, indicate the presence of phytochemicals such flavonoids, carotenoids, and anthocyanins, as well as poly phenols. Fresh edible flowers can be used as a main ingredient in cosmetic and therapeutic products as well as consumed on

their own. They can also be utilised as ingredients in functional foods. The following is a list of several edible flowers and their health advantages. (Table.1)

Table 1: Health Benefits of some Edible Flowers

Flowers	Health Benefits	Reference
Rose	Bile secretion is improved, the liver is cleaned, and minor bronchial infections and sore throats are also relieved.	Chen and Wei (2017). Hegde *et al*., (2022), Mileva *et al*., (2021)
Lily	Flavonoid that promotes arterial dilation; heart health.	Abelti *et al*., (2023), Maleki *et al.,* (2019).
Chrysanthemum	Blood detoxification, blood pressure control, nerve relaxing, antimicrobial properties, hypertension, and angina.	Shahrajabian *et al.,* (2019), Cookson (2021).
Jasmine	Parkinson's illness, alcoholism, attention deficit hyperactivity disorder, irritable bowel syndrome, and premenstrual syndrome. It has a slight calming effect, controls insulin levels, and can be applied topically.	Chen and Wei (2017). Al-Snafi, (2018)
Chamomile	It soothes indigestion and diarrhoea. It contains anti-inflammatory and antioxidant effects.	Talebi *et al.,* (2022).
Purple Corn Flower	Reducing coughs and sore throats; treating inflammation and pain.	Sultana *et al.,*(2016).
May Flower	Contains antioxidants that enhance heart health by decreasing blood pressure, increasing blood flow, and enhancing heart function.	Li *et al.,* (2022). Wu *et al.,* (2020), Cloud *et al*., (2020).

IV. NUTRITIONAL COMPOSITION OF EDIBLE FLOWERS

Edible flowers often have the same nutritional profile as other plant parts. The focus of current research on edible flowers, however, has been on the investigation of bioactive compounds and their antioxidant potential, including anthocyanins, flavonoids, and carotenoids [11]. Such research are justified by the effects of these phytochemicals on human health and by their ability to stop some illnesses and disorders. Pansies, centaurea, borage, and camellia are just a few of the flowers that gourmet chefs commonly include in their recipes. These flowers may be purchased worldwide at stores that specialise in selling edible flowers. The details of a few edible flowers' nutrient profiles are discussed here.

1. **Pansies:** Pansies have a wide variety of petal colors and a fragrant, sweet flavor, which are qualities that both chefs and customers appreciate. White pansies showed significantly higher moisture levels (91.3 g/100 g fw) than other flowers, whereas yellow pansies had the highest fat content (1.31 g/100 g fw). White pansies have the least amount of

nutritional fiber. The two main fatty acids present in red and yellow pansies are linolenic and palmitic acid, respectively. Because -tocopherol was present, yellow pansies had the greatest level of total tocopherols (24.89 mg/100 g dw). Oleic acid is found in higher concentration in red pansies. In white pansies, it was the behenic acid (C22:0, 24.6%), closely followed by the arachidic acid (C20:0, 24.3%). Yellow pansies had the widest range of fatty acids, while other coloured pansies revealed different profiles of fatty acids [11].

2. **Borage:** Borage has the highest levels of protein (3.04 g/100 g fw) and minerals (2.05 g/100 g fw). The two main fatty acids present in borage are linolenic acid and palmitic acid.

3. **Camellia:** Camellia had the lowest amounts of ash (0.37 g/100 g fw), fat (0.31 g/100 g fw), and protein (0.76 g/100 g fw). The major fatty acid in camellias is palmitoleic acid, which is present in high concentrations [11].

Antirrhinum majus, Snapdragon

Borago officinalis, Borage

Calendula officinalis, Pot marigold

Dianthus chinensis, Chinese pink

Gardenia jasminoides, Gardenia

Hemerocallis spp., Day lily

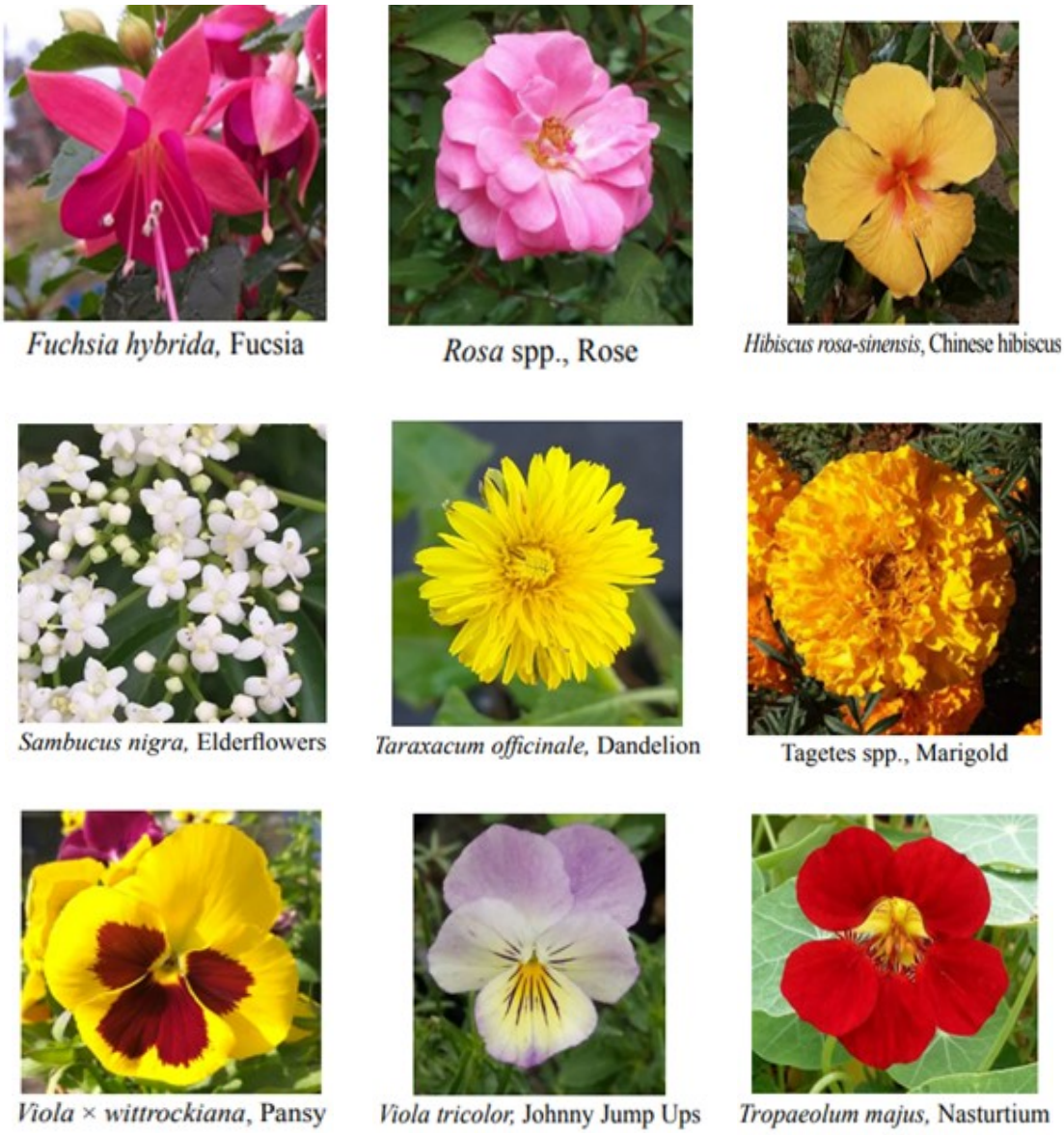

Figure 1: (Santos and Reis, 2021) Shows Some Examples of Edible Flowers

V. EDIBLE FLOWERS IN CULINARY

Around the world, a variety of flowers are utilised in cooking. During the off-season, certain flowers are dried and stored for consumption. Due to the value of flowers and their numerous uses, Deka and Nath (2014) performed a study to catalogue the species and the conventional knowledge associated with them in the West Assam region of India [30]. South Indian cuisine in India also features a lot of delectable flowers. In addition, there are numerous mouthwatering flowers and application techniques used in the various socio-geographical regions.

The Assam Western area, which is a part of the state of Assam, is a good place for numerous edible flower species to develop and survive. Western Assam has one of the greatest reserves of wild food plants and is rich in floristic diversity because of its unique geographic location. Many indigenous tribes around the world depend on wild food plants. Numerous cultures in this area have employed a variety of natural plants for centuries. In India, some of the flowers are either made into curry, fried with flour or even consumed as raw. Some flowers, including those from the Gumhar (*Gmelina arboria*), Midnight horror (*Oroxylum indicum*), Ram basak (*Phlogacanthus thyrsiformis*), Malabar nut (*Justicia adhatoda*), Pulutus (*Dendrocnide sinuate*), Papaya (*Carica papaya*), and Night jasmine (*Nyctanthus arbortristis*), are cooked in rice flour and eaten as a side with curry [30].

When cooking flowers, it is occasionally necessary to use the traditional alkali (known locally as kola Khar), which is made by burning the rhizome of a banana plant and extracting the liquid after soaking the ash in water. Oofcourse, the floral recipe is typically served with little fish or with dry fish. The various species of Arum (*Alocasia acuminateare*), Papaya (*Carica papaya*), Kanakachu (*Lasia spinosa*), and Wild nongmangkha (*Phlogacanthus Curviflorus*) are among the floral ingredients utilized in this dish. This is a typical meal that is very well-liked essentially throughout the entire state of Assam. Some of the flowers which are commonly consumed in India and benefits are discussed below.

1. **Midnight Horror (*Oroxylum indicum*):** The Oroxylum indicum plant, whose blossoms can both prevent and heal diseases including malaria and the worst malignancies. The indigenous people of Assam, India, consume the majority of these blossoms.

2. **Marigold – Potted plant (*Calendula officinalis*):** Ray flowers, or portions of them, are occasionally used in salads in Switzerland after being used for the first time in Danish salads in the early period (1800s). Ray flowers are only approved for topical application or as a mouthwash or gargle by The European Medicines Agency (EMA) in Europe [9]. The ingestion of *C. officinalis* flowers has no known negative effects on people. Ray flowers include carotenoids, triterpene saponins, ionone-, triterpene alcohols, and sesquiterpene glycosides, as well as polysaccharides, coumarins (scopoletin, umbelliferone, and asculetin), and triterpene alcohols [10].

3. **Garland Chrysanthemum *(Chrysanthemum coronarium L.)*:** The campor substance, which is used to flavour meals all around the world, is derived from flowers. The amount of camphor in the flowers does not represent a health danger; an adult (70 kg) can ingest more than 3 kg of fresh flowers before meeting the acute toxicity limit for camphor (based on 0.13% essential oil with 29% camphor). *C. coronarium* does not include *Tanacetum cinerariifolium* (Trevir.) Sch. Bip., a distinct species of Chrysanthemum from which pyrethrines have been isolated.

4. **Borage (*Borago officinalis* L.):** In Switzerland and Denmark, flowers have been consumed as a snack, a spice, and in salads. In the 1700s, children in Spain began using the blossoms as salad decorations and as a source of nectar. While it has been shown that *B. officinalis* contains poisonous 1,2-unsaturated pyrrolizidine alkaloids in its aerial portions, which could be dangerous if taken by humans.

5. **White Dead Nettle (*Lamium album* L.):** In addition to eating leaves and flowers in traditional Mediterranean recipes, children and adults in Estonia and Switzerland have been known to snack on shoots while working in the fields [1]. The essential oil of the flower is rich in terpenes, alcohols, alkanes, and ketones. Verbascoside and isoverbascoside made up 55% of the measured phenols in the aerial sections, which included flowers, leaves, and stems. Verbascoside was not genotoxic in vivo in two strains of *Drosophila melanogaster*, but the findings might be related to the substance's limited stomach absorption [24]. Therefore, BLV approves the use of the plant for infusions but not for everyday use.

6. **Garden Nasturtium (*Tropaeolum majus* L.):** In Europe, flowers have been eaten or used as food ingredients since the 1600s. According to ethno botanical studies, salads were used to flavour and adorn meals in Switzerland, Denmark, and Estonia during the 1800s and 1900s. Erucic acid makes up the bulk (34.5%) of the fatty acids, or 12.4% of the dry weight, in the flowers' high fatty acid content (36% of dry weight). Extracts of the leaves (both aqueous and 70% ethanolic) were tested for acute oral toxicity when given to Wistar rats or mice, but no negative effects were noticed. Therefore, while leaves should not be taken in little amounts, blooms can.

7. **Agathi (*Sesbania grandiflora*):** Agathi (*Sesbania grandiflora*) is consumed as pokora, also known as bor in the Assam region of India.

8. **Crape Jasmine (*Tabernaemontana divaricata*):** Flowers of crape jasmine is also fried and eaten as pakora in regions of India.

9. **Drum Stick (*Moringa oleifera*):** The drum stick, *Moringa oleifera*, flowers are consumed after being fried with an egg. There are several findings on the biological and physiological activity of *Moringa oleifera* in addition to its traditional usage as a food and medicine. These include the management of heart disease, ulcers, and dyspepsia, as well as hypoglycemic and hypo cholesterolemic effects that are also analgesic, anti-inflammatory, and antihelmintic. When in bloom, the drumstick plant resembles a leguminous species.

10. **Water Lily (*Nymphae spp*.):** After frying, the flower of the water lily (*Nymphaea spp*.) is frequently used because it is said to be useful against anemia. These things are regularly prescribed to young girls or women who are anemic.

11. ***Musa Spp*.:** Due to the high iron content of Musa spp. floral spadix, they aid in speeding up blood hemoglobin growth and speed the healing of burns and cuts on patients. Various Assamese tribes and clans frequently prepare Musa spadix together with pigeon meat using a traditional spicy, tasty recipe. This mixture works wonders to treat low blood pressure, fever, colds, and cough. In South Asian and Southeast Asian cooking, banana hearts are utilized, either raw, steamed with dips, or cooked in soups and curries.

12. ***Cassia siamea:*** The Caesalpiniaceae family plant, *Cassia siamea*, has edible flowers. The use of different Cassia species in various nations would draw attention to the plant for its pharmacological, traditional, and therapeutic properties.

Some other plants like Pumpkin (*Cucurbita moschata*), Drum stick (*Moringa oleifera*) flower, and arrow leaf *Monochoria hastata*, an oval-leaved pond weed, is an energy-giving plant. Calcium is found in the flowers of plants including common arum (*Alocasia acuminate*) and kanakachu (*Lasia spinosa*). Therefore, they are recommended for women, especially during pregnancy, and are excellent for bone formation.

These are some of the commonly consumed flowers which are be taken by many people through generations. The flowers may vary accordingly to their region of origin and practice of the native people.

VI. HARVEST AND STORAGE OF EDIBLE FLOWERS

Harvesting for edible flowers

1. When to Harvest for Edible Flowers

- Blooming
- Fully open
- Not under-ripe

Morning is the best time to harvest, when plants are fresh, contain the maximum amount of scent, flavor and turgid.

2. Harvesting Depend on the Type of Flower

- For some plants such as dill or fennel, the entire flower heads can be harvested and used. For others, like roses , pick off the petals individually is recommended.
- For Lavender flowers, florets can be picked off the stem directly as well.
- For Nasturtiums and viola blooms : cut just below the flower with a sharp equipment.
- To decorate a cake, making sure the flowers are still intact. For teas, dry the flowers.
- Some flowers can be eaten as a whole such as Nasturtiums, male squash blossoms, and clover. Petals are the delicately flavored portion in most of the flowers.
- To improve the taste, the rest of the flower parts, such as stamens with their pollen and pistils, should be removed.
- To reduce the bitterness in the culinary items, one has to remove the sepals, or green petals at the base of the flower, the white base of petals (rose petals).

VII. STORAGE

1. After harvest, dip the flowers or petals in cool water to rinse off any excess dirt particles.
2. Lay the flowers out to dry on a paper towel, instead of salad spinner.
3. The flowers can be stored up to a week in a basket or container lined with moist paper towels to maintain the humidity, placing the flowers on top, and popping it into the fridge. But It’s best to use the flowers as soon as after harvesting.
4. To prevent the flowers from crushing, sticking to one another or with bag, avoid plastic bags.
5. Letting the flowers to float in an ice water bath for a few minutes before using to revive the flowers from wilt.

6. For herbal tea blends, the flower can also be dried in a dehydrator or a low oven**.**

VIII. RISKS

Foods can benefit from the distinct flavor and captivating appearance of edible flowers. It is crucial to correctly identify each kind of flower and understand which portions of the flower should be eaten because not all flowers are edible. Only little amounts of some flowers can be eaten without risk. Pesticide traces are frequently found in flowers, which also frequently harbor other species like insects.

Flowers grown for decorative purposes in gardens are not meant to be consumed. It is best to avoid common garden flowers that contain harmfull contents in it.

1. Saponins are found in Johnny Jump-ups (*Viola tricolour officinalis*) flowers.
2. Apple flowers (*Malus spp.*) contain precursors to cyanide.
3. Both Borage (*Borago officinalis*) and daylilies (*Henterocallis spp*.) are diuretics.
4. Blood may be thinned by the herb sweet woodruff (*Galiunt odoratum*).
5. In moderation, Linden tree (*Ilia spp.*) blooms are safe, but ingesting too many can be harmful to the heart.
6. Despite having a delicious flavour, marigolds (*Tagetes spp*.) can be harmful in large quantities.
7. The edible petals of the plant with an oblong form known as a Begonia (*Begonia tuberhybrida*). Oxalic acid can be found in the petals, thus they should only be eaten occasionally. Additionally, the petals should not be consumed by those who have gout, kidney stones, or rheumatism.
8. Pregnant and nursing women should avoid borage (*Borago officittalis*) flowers since eating more than eight to ten of them can cause milk to flow. Given that they could possibly have a diuretic impact, they shouldn't be ingested in big amounts.
9. The fake jasmine (*Gelsemium sempervirens*), which is from a completely different species and is not the real jasmine (*Jasminum officinale*), is too dangerous for humans to consume.
10. In excess, *Tagetes patula, Tagetes tenudolia,* and *Tagetes patula* x *erecta* marigolds can be harmful. They should only be used sparingly and on special occasions.
11. The only edible variety of phlox is the perennial *Phlox paniculata.* Low-growing and annual kinds cannot be eaten.

IX. CONCLUSION

Edible flowers are receiving new attention globally, and their market is expanding, as a result of the rising gourmet usage of edible flowers and the interest of many businesses in innovative ingredients for the creation of new goods. Edible flowers can be used to enhance the flavour and charm of many different culinary recipes.

It may appear novel to include flowers in cuisine, however this practise dates back to previous civilizations. Due to this, many Edible flowers have established applications through tradition; however, for many species, it is still necessary to understand the chemical composition and, specifically, the maximum daily consumption, in greater detail. It is crucial that the information reaches both the makers and the customers in order to increase

confidence and security in the use of these products. The significant buildup of biologically active substances may be a result of environmental stressors that plants faced during their growth.

Because emerging food with edible flowers can be produced for less money at a lesser environmental and economic cost, using wild plants may benefit the local economy. Future evaluation and assessment of edible flowers' sensory qualities and post-harvest performances will be crucial to promoting their consumption. Furthermore, the produce could be standardized through improved cultivation procedures.

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