



ISSN (E): 2277-7695
 ISSN (P): 2349-8242
 NAAS Rating: 5.23
 TPI 2023; 12(7): 2597-2604
 © 2023 TPI

www.thepharmajournal.com

Received: 18-05-2023

Accepted: 22-06-2023

Tejaswi Swarna

Department of Fruit Science,
 Lovely Professional University,
 Jalandhar, Punjab, India

Nutritional and medicinal value of edible flowers

Tejaswi Swarna

Abstract

Edible flowers are utilized in food preparation and help food look more aesthetically pleasing. However, they are more usually reported in relation to biologically active compounds. Current knowledge regarding the use of edible flowers for human nutrition is presented in this review. The quality, sources, consumption, nutritional value, and sensory significance of edible flowers are discussed in the study. It is also considered from the perspective of any potential health effects how important edible flowers are. It mainly focuses on the relationship between flavour, aroma, and colour components and antioxidant activity, reactive oxygen radical scavenging, and cancer prevention. Due to their nutritional and chemoprotective benefits, edible blooms can be a new source of nutraceuticals.

Keywords: Edible flowers, health benefits, antioxidant activity, bioactive compounds, fatty acids, nutritional composition

Introduction

Most fruits and vegetables are very rich in phytochemicals which as flavonoids and phenolic acid, in recent years people get too aware of edible flowers and their nutraceutical value. They are used in culinary art for flavour and garnish for hundreds of years, the edible parts like stem, leaves, flowers, roots, seeds, pollen, pods etc. [1-3].

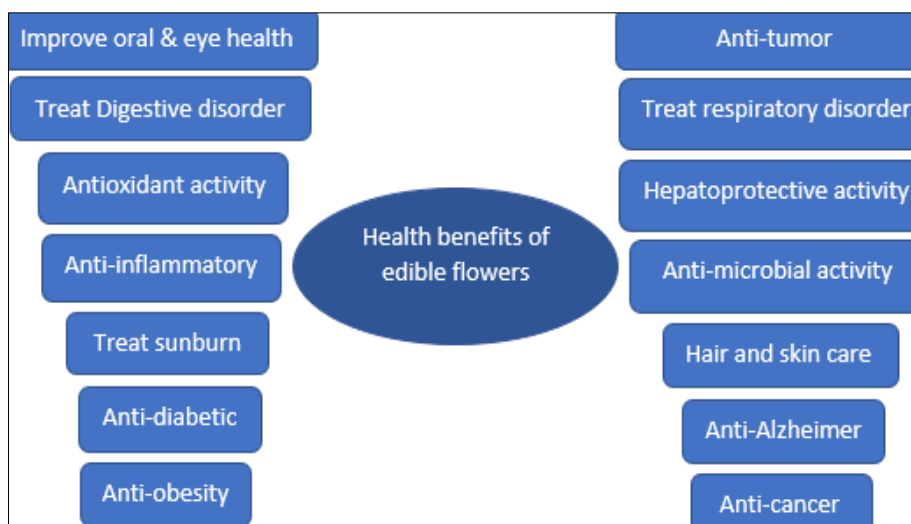
Edible flowers are rich in phenolic acid which is very strong *in vivo* and *in vitro* antioxidant activity [4-6]. Edible flowers are getting new interests. Flowers are used as an essential ingredient in the recipe and provide seasoning to use as garnish or seasoning to dishes in Asia, the Middle East and Europe [7, 8]. Most studies focused on essential oil and flavours in flowers [9, 10]. Research on edible flowers has revealed low-calorie content, high levels of vitamins, minerals, mucilage, amino acids, fibre, carbs, essential oils, and proteins [11-13]. Numerous researches have shown that edible flowers have potent therapeutic qualities, including anti-diabetic, anti-cancer, anti-anxiety, anti-inflammatory, antibacterial, diuretic, and immunomodulatory effects [14-16]. Such edible wild plant blooms, consumed by locals, serve a crucial part in people's diets, at least for a brief time after they bloom. In any event, it's critical to understand the nutritional makeup and other aspects of appetising foods for human nutrition. According to their immediate structure, most edible flowers are made up of water (over 80%), with varying levels of total sugars, minerals, and dietary fibre depending on the type of flower. Their fat and protein content are also considered to be minimal [17, 18]. The investigation on dietary characteristics of edible flowers (*Agave salmiana*, *Euphorbia radicans* Benth, *Arbutus xalapensis*, *Erythrina americana*, *Erythrina caribaea*, *Cucurbita pepo*, *Yucca filifera* and *Aloe vera*) showed that 860 and 932 g kg⁻¹ of moisture, 113 to 275 g kg⁻¹ dried matter of crude protein and 104 to 177 g kg⁻¹ DM of crude fibre were present [18, 13]. Technology may be created to produce a variety of value-added goods from *Madhuca longifolia*'s dried flowers, such as sweets, cake, toffee, squash, and Lado [44].

Local flowers are reportedly utilised not only as food but also as medicines to treat and prevent ailments [22]. Chrysanthemum flower has a significant role in traditional Chinese medicine (TCM), including those for reducing cold symptoms, detoxification, and eyesight enhancement [23]. Traditional uses of several edible flowers as medicines have led to the discovery of their biologically active components and possible health benefits [24]. These bioactive substances, for instance, offer numerous advantageous qualities including anti-inflammatory, antibacterial, antidiabetic, diuretic, antifungal, and others that can reduce the risk of cardiovascular and cancer disorders [8, 25-32], they are effective in reducing the risk of various illnesses [33]. These bioactive compounds may have a sustained impact on the body as strong antioxidant activities (AA) have shown discovered following the *in vitro* digestion of some flowers [34]

Corresponding Author:

Tejaswi Swarna

Department of Fruit Science,
 Lovely Professional University,
 Jalandhar, Punjab, India



Not all flowers are edible; to be consumed by humans, flowers must be non-toxic, harmless (given the existence of biological and chemical dangers), and have nutritional qualities [19, 20]. Trypsin inhibitors and other poisonous compounds are present in some flower species, which might decrease their nutritional value or harm consumers severely. Examples of these toxic substances include those found in hemagglutinins, oxalic acid, cyanogenic glycosides, and alkaloids [18, 19, 21]. The bio accessibility has also been assessed by more sophisticated investigations. Linking the phytochemicals' bioavailability from edible flowers to supply more insightful details on a range of phenolic acids, flavonoids, and anthocyanins contain. Accordingly, *Torenia fournieri* had a bio accessibility of about 176% for catechin, whereas *Clitoria ternatea*, *Tagetes patula*, and *Dianthus chinensis* had the greatest bio accessibilities for procyanidin B2, kaempferol-3-glucoside, and hesperidin, respectively [97]. has revealed that the extracts of *C. officinalis* during the stomach phase of digestion include vanillic acid, caffeic acid, syringic acid, and epicatechin. Following the stomach and duodenal phases of floral digestion, rutin, isoquercitrin, and quercitrin were accessible [98].

List of edible flowers

Chives flower

Allium schoenoprasum, it contains vitamins (C, A, K), antioxidants, minerals like Calcium, folate, potassium. Health benefits of chives are anticancer, depression, cognitive, reduces the risk of breast cancer, cardiovascular disease and stroke, eye health, inflammation and dietary consideration [40].

Alliums flower (Garlic)

Allium sativa, *Allium* health benefits are not just limited to bulbs, leaves, and stem but also extend to the bloom. Medicinal allium flowers have benefits like immune system, heart attacks, anti-diabetic, anti-microbial, anti-inflammatory, anti-cancer [41].

Nasturtiums

Tropaeolum majus, it contains nutrients like vitamin C manganese, iron, beta carotene and flavonoids and helps increasing the immune system, tackling sore throat, cold and cough, as well as fungal and bacterial infection [42, 35, 36]. In comparison to the artificial antioxidant butylhydroxytoluene added to foods, *C. officinalis* extract demonstrated higher

antioxidant activity (AA) [26].

Marigold

Tagetes erects, it is rich in carotenoids and carotenes, antiinflammation, antimicrobial, antioxidant, ease the spasms, haemorrhoid pain, cramps, eye health, antiseptic properties like healing, skin wounds, burns, rashes. And used as natural food colouring, perfume [43].

Pansies

Viola tricolor, it contains carotenoids, saponins, tannin, and vitamin C, it can treat on mild hives, gives relief from anxiety, treatment for rheumatism and arthritis, treats urinary tract infection, treats bronchitis, relieves from cough and sore throat, treats dandruff, and also works as anti-fungal and anti-bacterial [44].

Calendula

Calendula officinalis, it contains carotenoids (Lutei and beta) which are converted into vitamin A by our body, flavonoids and contains fatty acid which are calendic and linoleic acids. This helps to fight cancer, protect from heart disease, ease muscle fatigue, it is also known for its anti-inflammatory and antioxidant components [45].

Anise hyssop

Agastache foeniculum, contains calcium, sodium, iron, copper, phosphorous carminative, and expectorant helps in curing digestive health, cold, cough, fever, diarrhoea. They have anti-bacterial, anti-inflammatory, they show great result in curing wounds, fungal condition, sunburns, and athlete's foot [43, 47].

Honeysuckle

Lonicera caprifolium, it contains vitamins A, B, C, fructose, glucose, the berry includes natrium, magnesium, potassium, manganese, zinc, iodine, flowers, seeds, berries, and leaves are used for medicine. Helps for digestion disorders, swelling of bronchiolitis, cancerous tumours, itching, bacterial or viral infection, sores, boils, headache, cold, fever [48, 49].

Borage

Borago officinalis, it is rich in gamma linoleic acid (GLA) which is an omega-6 fatty acid, helps to reduce inflammation, asthma rheumatoid arthritis, respiratory, digestive disorders,

atopic dermatitis, it has been used to dilate blood vessels, act as sedative and seizures [50].

Chamomile

Matricaria recutita, it helps in insomnia, anxiety, digestive issue, stomach ulcer, diarrhoea, antioxidant, wound healing, chronic leg ulcer, eczema which includes mild irritation, sunburns, rashes, sores, even eye inflammations, diabetes, helps to decrease cholesterol, oral health, anti-microbial, anti-inflammatory [51].

Daylily

Hemerocallis, it contains fats, carbs, protein and source of vitamin C, calcium, potassium and carotene, the root help in anti-tumour compounds, the flower and leaves have a mild laxative, antiemetic, febrifuge, antispasmodic, sedative and also the herb help to purify the blood [52]. Large quantities of leaves can cause hallucinogenic. Both lipid peroxidation and strong ROS scavenging activities were seen in daylily extracts [37, 38].

Mint

Mentha piperita, it contains vitamin A, iron, manganese, folate, it helps in reducing gas, bad breath, eye health, night vision, menstrual pain, diarrhoea, nausea, depression-related anxiety, muscle and nerve pain, common cold, indigestion, bloating, calming skin irritation and itchiness, reduces headache, nausea (reduces nausea, vomiting, retching in chemotherapy patients) and contains antimicrobial components [53].

Squash blossoms

It is high in calcium, iron, vitamin A&C, it is good for bones, increasing in red blood cells, increases immune system [54, 55]. While the high content of beta-carotene content provide many benefits.

Rose

Rosa, It contains vitamin C, iron, calcium, carbohydrates, citronellol, geraniol, neroli, linalool, phenyl ethyl alcohol, farnesol, stearoptene, α -pinene, β -pinene, α -terpinene, limonene, p-cymene, camphene, β -caryophyllene, neural, citronellal acetate, geranyl acetate, neryl acetate, eugenol, methyl eugenol, rose oxide, α -damascene, β -damascene, benzaldehyde, benzyl alcohol, riodinid acetate and phenyl ethyl format. it helps in strengthen the digestive process, high in antioxidants, lose weight, boost the immune system, expel toxin from body, excellent for hair and skin care [56].

Thyme

Thymus vulgaris, it is packed with helpful nutrient vitamin A&C, copper, fibre, iron, manganese. its anti-bacterial against P. acnes, lower heart rate, lower their cholesterol, reduce inflammation and mucous, fungicidal against Candida albicans a common cause of yeast infection heal cough or sore throat [57].

Violet

Viola odorata, this are rich in calcium, magnesium, vitamin A&C and also has a phytochemical called as rutin. It helps in prevent chronic disease like cancer, insomnia, improves lung health, treats upper respiratory tract and cold, congestion, flu viruses, bronchitis and a gentle immune system stimulant, it

has salic acid which helps in skin with disinfecting and active fungicide, reduce swelling and inflamed skin, sores, varicose veins, haemorrhoids, reduce puffiness of the eyes [58, 59].

Arugula

Eruca vesicaria, it contains calcium, iron, vitamin A, C & K, potassium, magnesium, folate. It is full of antioxidants, glycosylates against certain cancer including breast, prostate, lung, colon cancer, good for bones fights inflammation [60]. If you take medicine known as blood thinner, too much vitamin K could undo their effects, that's because vitamin K is important to blood clotting process.

Lavender

Lavandula, it helps in insomnia, anxiety, hair loss, headache, migraine, chemotherapy side effects, acne, burns, eczema, dry skin, wound healing, mood issues, stress, anxiety, depression, psoriasis, rashes, dermatitis, wound healing [61].

Lovage

Levisticum officinale, it contains phthalides, coumarins, phenylpropanoids, it helps in indigestion, heartburns, intestinal gas, irregular menstrual period, sore throat boils, jaundice, gout, migraines, (Irrigation therapy) for urinary tract inflammation and kidney stones, malaria, gout, tonsillitis, rheumatism [62, 63].

Cilantro

Coriandrum sativum, they are rich in micronutrients and antioxidants, fibre, vitamin A, C, K, calcium, magnesium, sodium and potassium. They help to protect the heart, indigestion, inflammation, antimicrobial, coriander leaves consumed with flowers keeps the blood sugar level in check [64].

Papaya flower

Carica papaya, it contains gallic acid, beta carotene, calcium, protein, carbohydrates, phenol, phosphorus, vitamin A, B1, B9, C&E and tannins, antioxidants, respiratory, mixed with honey helps in cough, sore throat, hoarseness, pain relievers, stabilize high blood pressure, prevent heart disease, significant change in insulin, nourish blood [65].

Banana flower

Musa coccinea, it contains antioxidants, sodium, high in fibre, vitamin C, B6, potassium, magnesium it may aid digestive health, prostate enlargement, support bone health, lower blood sugar & cholesterol level, healthy immune system, and red blood cell development, prevent chronic condition, regulate fluid balance, bloating, improve sleep, heart disease risk [66].

Mahua

Madhuca longifolia, contains sucrose, glucose, fructose, arabinose, few amount of maltose and rhamnose it helps chronic bronchitis, rheumatism, cure eye diseases, raktapitta, headache, nasal drops, cure diarrhoea, colitis, increase lactation, cure piles, eczema, fever, heart disease, leucorrhoea, menorrhagia, polyuria, bronchitis, tonsillitis, rheumatism, diabetes, chronic bronchitis, mellitus [67, 68].

Moringa

Moringa oleifera, it is a good source of vitamin A, C, calcium, potassium, iron and amino acid, which helps to boost

the immune system, protect all over vision, increase milk production in nursing mother, reduces inflammation and swelling, strengthen bones, helps with cold and cleansed the body [69].

Jasmine

Jasminum officinale, it contains alpha terpineol, benzaldehyde, benzyl acetate, benzyl alcohol, eugenol, farnesol, geraniol, jasmone, nerolidol, linalyl, acetate, salicylic acid and vanillin it is good cardiovascular health, prevent cancer, boost immunity, fights cancer, in digestion, prevent type 2 diabetes, treats stress, dysmenorrhea, amenorrhea, treats insomnia, improves immune system, antioxidant properties, heals injuries, reproductive health, wound healing, otorrhea treatment, alleviates aches and pains, overcome shortness of breath, eyewash solution, weight loss aid, rheumatism treatment, treats gallstones, cures oral problems, overcome colitis, overcome dengue, overcome inflammation of the kidneys, improves cognitive functioning [70, 71].

Dandelion

Taraxacum officinale, it is highly nutritious with vitamin A,C,K,E,B, folate, iron, calcium, magnesium and potassium, beta carotene, polyphenols, it helps to maintain healthy gut bacteria, chronic disease risk, protect against cell damage and oxidative stress, may help fight inflammation, decrease blood sugar, improves insulin sensitivity, reduce cholesterol and triglyceride level, lower blood pressure, promote liver health, anticancer effect, healthy digestion and treat indigestion, boost immune health, use as useful skin care treatment, support healthy bones [72].

Sage

Salvia officinalis, it is contain vitamin K, rich in rosmarinic acid antioxidant and anti-inflammatory neutralize harmful compounds called free radicals, decrease inflammation, blood sugar levels, bone health, circulation and proper blood clotting, skin and wound healing, skin cell growth, decrease wrinkles, promotes oral health, sore throat, anticancer properties, improves blood sugar level, promote brain health, and improves mood, boost heart health [73].

Passionflower

Passiflora incarnate, it contains vitamin A, antioxidant, chrysin, benzoflavone, vitexin, iso vitexin, kaempferol, quercetin, rutin, apigenin, luteolin glycosides, also contains alkaloids, fatty acid, maltol, phytosterols, sugars and trace of volatile oil, it helps inhibits inflammation, relax nervous system, relieve back pain, lower blood pressure, restore skin barrier, insomnia, [74].

Sunflower

Helianthus annuus, it contains vitamin E, B1, B6, copper, it helps prevents cell damage, supports digestion, promote level of energy, bone health, promote brain function [75]. It doesn't have any severe effects, but it might be allergic to some people.

Bachelor's button

Centaurea cyanus it contains vitamin C, ascorbic acid, calcium, folate, it helps in reduce inflammation, produce red blood cell, protects bones and teeth, anti-inflammatory, sore

gums, stomach ulcers, UTI infection, liver detoxification, polstice for aching and sore muscles and even use open wounds for bleeding unlike arnica [76, 77].

Holly hocks

Alcea rosea, it is anti-inflammatory, it helps in antispasmodic, healing, antipyretic, antimicrobial, antibacterial, analgesic, antirheumatic, digestive, decongestant, febrifuge, emollient, diuretic, demulcent [78].

Echinacea

Echinacea purpurea, it has active antioxidants compounds like dichroic, caffeic acid, aklomides, phenolic acid, Rosmarinus acid, polyacetylenes, it helps to reduce inflammation, chronic disease, diabetes, heart disease, boost immune system, common cold, may lower blood sugar levels, blood sugar, reduce feeling of anxiety, anti-inflammatory, help trat skin concern, protection against cancer [79].

Fever few

Tanacetum parthenium, it contains parthenopid, it helps in migraine headache, calms rheumatoid arthritis, heals dermatitis, potentially combats cancer, prevent blood clots, reduces the risk of death from heart attack [80].

Ginger flower

Etlingera elatior, it contains antioxidants, antibacterial, vitamin C&K, calcium, magnesium, it helps to boost immunity, protects body against external aggression, regulate nerves system, wound healing, build strong bones and teeth [81].

Fennel flower

Foeniculum vulgare, it contains antioxidants, anti-inflammatory, anti-bacterial, vitamin C, magnesium, calcium, iron, potassium, it is very low in calories, it helps in detox, ease menstrual symptoms, improves mental health, benefits breast feeding women, have cancer fighting properties [82].

Lime flower

Citrus aurantiifolia, it contains more than 1% flavonoids, such as hyperoxide, quercetin, myricetin galactoside, kaempferol, farnesol, kaempferol glycosides, astragal, and its 6-p-coumaric acid ester, tiliroside; about 10% mucilage, primarily made up of arabino-galectins; proanthocyanins; caffeic, chlorogenic, and it helps in cold, flu symptoms, inflamed membrane in respiratory tract, digestive health, stress & anxiety, heart health [83].

Lilacs

Syringa vulgaris, it helps in beneficial for sore mouth, parasitic, parasitic worms, malaria, fever, rashes, sunburn, minor cuts, scrapes, cataracts, diphtheria [84].

Carnations

Dianthus caryophyllus, it helps in relief from pain, swelling, infection, stress, depression, coronary disorders, nausea caused by seasickness, keep skin soothing & calming, used in endometriosis, proliferation in pelvic organs such as ovary and fallopian tubes, insomnia, hormone imbalance, indigestion, facial wrinkles, rosacea, eczema [85].

Peony flower

Paeonia officinalis, it is rich in protein, organic acid, amino acid, mineral element, flavonoids, polyphenols, anthocyanins, carotenoids, fibres, volatiles, and it has antispasmodic, anti-inflammatory, antibacterial, it is beneficial to skin, fights tissue aging, soothe skin rashes, soothe digestive tract and gastric pain, help fall asleep and extend sleeping cycle, cough [86, 87].

Apple blossoms

Malus domestica, it contains vitamin C, iron, sodium, carbohydrates, protein, it helps in Improves digestion, eliminates extra fat, treats acne, lightens pigmentation, calms nerves, and revitalises blood. favourable to the skin [88, 89].

Rhododendron

Rhododendron, it contains potassium, calcium, vitamin C, iron, zinc, copper, phytochemicals like phenols, saponins, xanthoproteic, tannins, flavonoids and active compounds like quercetin, rutin, quinin acid and coumaric acid, it helps in anti-bacterial, anti-inflammatory, anti-diabetic, treat gout, rheumatoid, bronchitis, arthritis, prevent anaemia, improve bone health, kidney problem, mouth ulcers, gastrointestinal, beneficial in treating COVID infection [90].

Lotus

Nelumbo nucifera, it contains antioxidant and anti-inflammatory, it helps treat diarrhoea, infection, cough, high blood pressure, fever, liver damage, Alzheimer's disease, lower blood pressure [91].

Hibiscus

Hibiscus rosa-sinensis, it contains carbohydrates, calcium,

magnesium, potassium, vitamin C, B, flavonoids, phenolics acid, organic acid, antioxidant compounds, it helps in lower blood pressure, obesity, metabolic syndrome, liver damage, cancer [92].

Agastya sesbania

Sesbania grandiflora, it contains vitamin B & C, protein, leucocyanidin, kaempferol, methyl- allenolate, it helps in hypertension, diabetes, healthy bones, cancer, tuberculosis, digestive system, respiratory system, reproductive system [93].

Long pepper

Piper longum, it is rich in alkaloids, beta sitosterol, analgesic, it also has ton of eugenol, glycosides, piperine, resins, pipartine, myrcene, terpenoids, quercetin, triacontane, sylvanite, it helps in insomnia, boosts reproductive system, treat anaemia, anorexia, indigestion, flatulence, abdominal pain, hyperacidity, piles, paralysis of tongue, diarrhoea, cholera, chronic malaria, viral hepatitis, disease of the spleen and tumour, reduce inflammation, strengthen nerves system, normalise peristaltic movements, diabetes, stimulates oxygen flow, epilepsy, toothache [94, 95].

Saffron

Crocus sativus, it contains vitamin B6, C&A, thiamine, riboflavin, niacin, folate, selenium, magnesium, phosphorus, copper, zinc, sodium, potassium, iron, calcium, it helps in pain relief, increase the sense of happiness and excitement, anti-inflammation, lower blood pressure, enhance breathing, indigestion, decrease sign of ageing, protect liver, protect spleen, lower blood cholesterol, protect heart, act as antioxidant [96].



Source: 99-103

Application of edible flowers

- 1. Beverage industry:** Flowers can be used to flavour beverages or to create beverages like tisanes and wines. They are included in condiments like vinegar, marinades, and sauces as well as spreads like butter or fruit preserves.
- 2. Daily meal:** Edible flowers have become a popular culinary item due to potent and distinctive smells, textures, and colours, they are used to enhance flavour, scent, and decoration. They can be added to salads or consumed as a component of a major meal.
- 3. Confectionary industry:** Edible flowers can be used to decorate cookies, cakes etc for beautification and nutritional purposes.
- 4. Pharmaceutical industry:** Due to medicinal properties, some of the edible flowers can be used in pharmaceutical industry. Presence of phenolic compounds in the flower's extracts reflected in good antioxidant, antimicrobial and anti-acetylcholinesterase activities showing to be

beneficial to human health [104].

- 5. New food:** Due to non-toxicity and nutraceutical properties, some of the edible flowers can be used as new food [105].
- 6. Garnishing dishes:** cooked dishes can be decorated by using edible flowers due to their pleasant colour, attractiveness, and beauty.
- 7. Natural food colour**
- 8. Perfumery and cosmetic industry**

Conclusion

Food safety has recently been a concern for manufacturers as well as consumers. There is now more demand for wholesome meals because of rising consumer health consciousness. Edible flowers with eye-catching hues are gaining popularity in addition to fruits and vegetables. It is difficult to consume them in fresh form due to their perishable nature. Worldwide, edible flowers are a plentiful natural resource, and many of them contain a variety of phytochemicals that have been

shown to have positive health effects. Recent research has verified the health advantages of numerous edible flowers, as well as their bioactive components and associated processes, even though many of them are historically employed as medicines to treat illnesses. Additionally, studies have emphasised the safety of popular edible flowers and defined their applications and doses. However, there are so many different edible flowers in the globe that only some of them have been thoroughly researched. In order to properly exploit edible flowers, boost their acceptance as possible food ingredients, and prevent any potential risks, we believe that additional study should be done.

References

1. Adisakwattana S, Ruengsamran T, Kampa P, Sompong W. *In vitro* inhibitory effects of plant-based foods and their combinations on intestinal α -glucosidase and pancreatic α -amylase. BMC complementary and alternative medicine. 2012 Dec;12(1):1-8.
2. Kaisoon O, Siriamornpun S, Weerapreeyakul N, Meeso N. Phenolic compounds and antioxidant activities of edible flowers from Thailand. Journal of functional foods. 2011 Apr 1;3(2):88-99.
3. Lu B, Li M, Yin R. Phytochemical content, health benefits, and toxicology of common edible flowers: a review (2000–2015). Critical Reviews in Food Science and Nutrition. 2016 Jul 29;56(1):S130-48.
4. Niki E. Assessment of antioxidant capacity *in vitro* and *in vivo*. Free Radical Biology and Medicine. 2010 Aug 15;49(4):503-15.
5. Qingming Y, Xianhui P, Weibao K, Hong Y, Yidan S, Li Z, *et al.* Antioxidant activities of malt extract from barley (*Hordeum vulgare* L.) toward various oxidative stress *in vitro* and *in vivo*. Food chemistry. 2010 Jan 1;118(1):84-9.
6. Chiang CJ, Kadouh H, Zhou K. Phenolic compounds and antioxidant properties of gooseberry as affected by *in vitro* digestion. LWT-Food Science and Technology. 2013 May 1;51(2):417-22.
7. Kaisoon O, Konczak I, Siriamornpun S. Potential health-enhancing properties of edible flowers from Thailand. Food research international. 2012 May 1;46(2):563-71.
8. Fernandes L, Casal S, Pereira JA, Saraiva JA, Ramalhosa E. Edible flowers: A review of the nutritional, antioxidant, antimicrobial properties and effects on human health. Journal of Food Composition and Analysis. 2017 Jul 1;60:38-50.
9. Gilles M, Zhao J, An M, Agboola S. Chemical composition and antimicrobial properties of essential oils of three Australian Eucalyptus species. Food Chemistry. 2010 Mar 15;119(2):731-7.
10. Mekni M, Flamini G, Garrab M, Hmida RB, Cheraief I, Mastouri M, *et al.* Aroma volatile components, fatty acids and antibacterial activity of four Tunisian *Punica granatum* L. flower cultivars. Industrial Crops and Products. 2013 Jul 1;48:111-7.
11. Benvenuti S, Bortolotti E, Maggini R. Antioxidant power, anthocyanin content and organoleptic performance of edible flowers. Scientia Horticulturae. 2016 Feb 16;199:170-7.
12. Grzeszczuk M, Stefaniak A, Meller E, Wysocka G. Mineral composition of some edible flowers. Journal of Elementology. 2018, 23(1).
13. Navarro-González I, González-Barrio R, García-Valverde V, Bautista-Ortín AB, Periago MJ. Nutritional composition and antioxidant capacity in edible flowers: Characterisation of phenolic compounds by HPLC-DAD-ESI/MSn. International Journal of Molecular Sciences. 2014 Dec 31;16(1):805-22.
14. Koike A, Barreira JC, Barros L, Santos-Buelga C, Villavicencio AL, Ferreira IC. Edible flowers of *Viola tricolor* L. as a new functional food: Antioxidant activity, individual phenolics and effects of gamma and electron-beam irradiation. Food Chemistry. 2015 Jul 15;179:6-14.
15. Chensom S, Okumura H, Mishima T. Primary screening of antioxidant activity, total polyphenol content, carotenoid content, and nutritional composition of 13 edible flowers from Japan. Preventive nutrition and food science. 2019 Jun;24(2):171.
16. Zhao L, Fan H, Zhang M, Chitrakar B, Bhandari B, Wang B. Edible flowers: Review of flower processing and extraction of bioactive compounds by novel technologies. Food Research International. 2019 Dec 1;126:108660.
17. Rop O, Mlcek J, Jurikova T, Neugebauerova J, Vabkova J. Edible flowers-a new promising source of mineral elements in human nutrition. Molecules. 2012 May 31;17(6):6672-83.
18. Sotelo A, López-García S, Basurto-Peña F. Content of nutrient and antinutrient in edible flowers of wild plants in Mexico. Plant Foods for Human Nutrition. 2007 Sep;62(3):133-8.
19. Lara-Cortés E, Osorio-Díaz P, Jiménez-Aparicio A, Bautista-Baños S. Contenido nutricional, propiedades funcionales y conservación de flores comestibles: Revisión. Archivos latinoamericanos de nutrición. 2013 Sep;63(3):197-208.
20. Alasalvar C, Pelvan E, Özdemir KS, Kocadağlı T, Mogol BA, Paslı AA, *et al.* Compositional, nutritional, and functional characteristics of instant teas produced from low-and high-quality black teas. Journal of Agricultural and Food Chemistry. 2013 Aug 7;61(31):7529-36.
21. Mlcek J, Rop O. Fresh edible flowers of ornamental plants—A new source of nutraceutical foods. Trends in Food Science & Technology. 2011 Oct 1;22(10):561-9.
22. Sirkhram N. Food culture in Lanna way of life. Journal of Food Health and Bioenvironmental Science. 2018 May 1;11(2):56-66.
23. Lin LZ, Harnly JM. Identification of the phenolic components of chrysanthemum flower (*Chrysanthemum morifolium* Ramat). Food Chemistry. 2010 May 1;120(1):319-26.
24. Roberts M, Green P Edible. Medicinal Flowers, 1st ed.; The Spearhead Press: Claremont, CA, USA; c2000. p. 166.
25. Fu M, He Z, Zhao Y, Yang J, Mao L. Antioxidant properties and involved compounds of daylily flowers in relation to maturity. Food chemistry. 2009 Jun 15;114(4):1192-7.
26. Rigane G, Younes SB, Ghazghazi H, Salem RB. Investigation into the biological activities and chemical composition of *Calendula officinalis* L. growing in Tunisia. International Food Research Journal. 2013 Nov 1;20(6):3001.
27. Kim GC, Kim JS, Kim GM, Choi SY. Anti-adipogenic effects of *Tropaeolum majus* (Nasturtium) ethanol extract

- on 3T3-L1 cells. Food & nutrition research. 2017 Jan 1;61(1):1339555.
28. Jurca T, Baldea I, Filip GA, Olteanu D, Clichici S, Pallag A, *et al.* The effect of *Tropaeolum majus* L. on bacterial infections and *in vitro* efficacy on apoptosis and DNA lesions in hyperosmotic stress. Journal of Physiology and Pharmacology. 2018, 69(3).
 29. Pires TC, Dias MI, Barros L, Calhelha RC, Alves MJ, Oliveira MB. Edible flowers as sources of phenolic compounds with bioactive potential. Food Research International. 2018 Mar 1;105:580-8.
 30. Verma PK, Raina R, Agarwal S, Kaur H. Phytochemical ingredients and Pharmacological potential of *Calendula officinalis* Linn. Pharmaceutical and Biomedical Research. 2018 Nov 10;4(2):1-7.
 31. Choi EM, Hwang JK. Investigations of anti-inflammatory and antinociceptive activities of *Piper cubeba*, *Physalis angulata* and *Rosa hybrida*. Journal of Ethnopharmacology. 2003 Nov 1;89(1):171-5.
 32. Kumari P, Bhargava B. Phytochemicals from edible flowers: Opening a new arena for healthy lifestyle. Journal of Functional Foods. 2021 Mar 1;78:104375.
 33. Arru L, Mussi F, Forti L, Buschini A. Biological Effect of Different Spinach Extracts in Comparison with the Individual Components of the Phytocomplex. Foods. 2021 Feb 9;10(2):382.
 34. Chen GL, Chen SG, Xie YQ, Chen F, Zhao YY, Luo CX, *et al.* Total phenolic, flavonoid and antioxidant activity of 23 edible flowers subjected to *in vitro* digestion. Journal of Functional Foods. 2015 Aug 1;17:243-59.
 35. Garzón GA, Wrolstad RE. Major anthocyanins and antioxidant activity of Nasturtium flowers (*Tropaeolum majus*). Food Chemistry. 2009 May 1;114(1):44-9.
 36. Barros RG, Andrade JK, Pereira UC, de Oliveira CS, Rezende YR, Silva TO, *et al.* Phytochemicals screening, antioxidant capacity and chemometric characterization of four edible flowers from Brazil. Food Research International. 2020 Apr 1;130:108899.
 37. Chen HY, Bor JY, Huang WH, Yen GC. Effect of sulfite-treated daylily (*Heimerocallis fulva* L.) flower on the production of nitric oxide and DNA damage in macrophages. Journal of Food and Drug Analysis. 2007;15(1):1.
 38. Que F, Zheng X. *In vitro* and *in vivo* antioxidant activities of daylily flowers and the involvement of phenolic compounds. Asia Pacific journal of clinical nutrition. 2007;16:196.
 39. Ramakrishnan RB. Evaluation of antioxidant and phytochemical activity in solvent extracts from *Delonix regia* flowers. International Journal of Green Pharmacy (IJGP). 2018 Nov 7;12(03).
 40. <https://www.medicalnewstoday.com/articles/275009>
 41. <https://www.therightflowers.com/medicinal-allium-flower-benefits/>
 42. <https://www.urbancultivator.net/learn-about-nasturtium>
 43. <https://www.petalrepublic.com/marigold-benefits/>
 44. <https://factly.com/lifestyle/wellness/health-benefits-of-pansies/>
 45. <https://www.webmd.com/diet/health-benefits-calendula-tea>
 46. <https://eattheplanet.org/anise-hyssop-a-fragrant-and-nutritious-herb/>
 47. <https://healthfromeurope.ca/blogs/blog/health-benefits-of-anise-hyssop>
 48. <https://www.rxlist.com/honeysuckle/supplements.htm>
 49. <https://starberries.com.ua/en/honeysuckle>
 50. <https://www.healthline.com/nutrition/borage>
 51. <https://www.webmd.com/diet/supplement-guide-chamomile>
 52. <http://mandeplants.blogspot.com/2015/06/the-edible-daylily.html>
 53. <https://www.healthline.com/nutrition/mint-benefits>
 54. <https://www.practicalhealthandwellnesssolutions.com/squash-blossoms-health-benefits-edible-flower/>
 55. <https://www.organicauthority.com/cooking-dictionary/squash-blossoms>
 56. <https://krishijagran.com/health-lifestyle/10-amazing-health-benefits-of-rose-flower/>
 57. <https://www.healthline.com/health/health-benefits-of-thyme>
 58. <https://www.healthbenefitstimes.com/violet/>
 59. <https://gardenculturemagazine.com/medicinal-weeds-the-many-benefits-of-wild-violets/>
 60. <https://www.webmd.com/food-recipes/benefits-arugula>
 61. <https://www.healthline.com/health/what-lavender-can-do-for-you>
 62. <https://www.rxlist.com/lovage/supplements.htm>
 63. <https://www.verywellhealth.com/lovage-benefits-side-effects-dosage-and-interactions-4686373>
 64. <https://www.thehealthsite.com/diseases-conditions/do-you-discard-coriander-flowers>
 65. <https://www.vinmec.com/en/news/health-news/nutrition/what-are-the-benefits-of-eating-male-papaya-flowers/>
 66. <https://www.healthline.com/nutrition/banana-flower-benefits>
 67. <https://www.plantmade.in/blogs/articles/benefits-of-mahua-flowers>
 68. <https://www.myupchar.com/en/herbs/benefits-of-mahua>
 69. https://specialtyproduce.com/produce/Moringa_Flowers_
 70. <https://www.healthbenefitstimes.com/jasmine/>
 71. <https://www.indigo-herbs.co.uk/natural-health-guide/benefits/jasmine>
 72. <https://www.healthline.com/nutrition/dandelion-benefits>
 73. <https://www.healthline.com/nutrition/sage>
 74. <https://www.indigo-herbs.co.uk/natural-health-guide/benefits/passion-flower>
 75. <https://www.healthbenefitstimes.com/sunflower/>
 76. https://specialtyproduce.com/produce/Bachelors_Button_Flowers
 77. <https://www.growcreatesip.com/blog/medicinal-and-culinary-uses-for-bachelor-buttons>
 78. <https://www.planetaryurveda.com/library/hollyhock-alcea-rosea/>
 79. <https://www.healthline.com/nutrition/echinacea#benefits>
 80. <https://draxe.com/nutrition/feverfew/>
 81. https://specialtyproduce.com/produce/Torch_Ginger_Flowers
 82. <https://www.timesnownews.com/health/article/what-are-the-health-benefits-of-the-fennel-flower-all-you-need-to-know>
 83. <https://www.indigo-herbs.co.uk/natural-health-guide/benefits/lime-flowers>
 84. <https://www.healthbenefitstimes.com/common-lilac/>
 85. <https://healthfully.com/70178-medicinal-uses-carnations.html>

86. Weixing L, Shunbo Y, Hui C, Yanmin H, Jun T, Chunhua Z. Nutritional evaluation of herbaceous peony (*Paeonia lactiflora* Pall.) petals. Emirates Journal of Food and Agriculture; c2017. p. 518-531.
87. <https://www.nature-and-garden.com/health/peony-health-benefits.html>
88. http://www.chudleighs.com/wp-content/uploads/2016/06/701108_03_Apple-Blossom
89. <https://www.laobanniang.com.sg/herbal-tea/apple-flower>
90. <https://www.etvbharat.com/english/national/sukhibhava/sukhibhava>
91. <https://www.healthline.com/health/8-uses-for-lotus>
92. <https://www.healthline.com/health/all-you-need-to-know-hibiscus>
93. <https://www.iafaforallergy.com/dravya-herbs-part-b/agastya-sesbania-grandiflora/>
94. <https://www.iloveindia.com/indian-herbs/piper-longum.html>
95. <https://www.lybrate.com/topic/long-pepper-pippali-benefits>
96. <https://pharmeasy.in/blog/ayurveda-uses-benefits-side-effects-of-saffron/>
97. https://en.wikipedia.org/wiki/Edible_flower
98. De Morais Watanabe EA, Alfinito S, Curvelo ICG, Hamza KM. Perceived value, trust and purchase intention of organic food: a study with Brazilian consumers. British Food Journal. 2020;122(4):1070-1184.
99. Images – <https://en.wikipedia.org/wiki/Hibiscus>
100. <http://www.flowersofindia.net/catalog/slides/Long%20Pepper.html>
101. <https://www.netmeds.com/health-library/post/banana-flower-the-superfood-you-havent-heard-of>
102. <https://www.shutterstock.com/search/papaya-flower>
103. https://en.wikipedia.org/wiki/Moringa_oleifera
104. Rezende F, Sande D, Coelho AC, Oliveira G, Boaventura MA, Takahashi JA. Edible flowers as innovative ingredients for future food development: anti-alzheimer, antimicrobial, and antioxidant potential. Chemical Engineering Transactions. 2019 Jun 15;75:337-42.
105. Benvenuti S, Mazzoncini M. The Biodiversity of Edible Flowers: Discovering New Tastes and New Health Benefits. Frontiers in Plant Science. 2021 Feb 22;11:569499.