Journal of Medicinal and Aromatic Plant Sciences 46 (2) : 43-50, 2024
ISSN 0253-7125 (Print)
https://doi.org/10.62029/jmaps.v46i2.shukla

Review Article

Importance and nutritional value with therapeutic properties of a traditional gulkand: A review

Ravi Kumar Shukla, Priyanka Singh, Vipin Kumar, Ravi Prakash Verma, Akshita Chakravarty, Ramesh Kumar Srivastava*

CSIR-Central Institute of Medicinal and Aromatic Plant, Lucknow, Uttar Pradesh, India.

Abstract

Rose flowers are considered an emerging nutraceutical due to their specific nutritional and medicinal properties. In ancient times, people used fresh rose petals or flowers to improve the flavor, taste and aesthetic appearance of foodstuffs. Petals of *Rosa damascena, R. centifolia* and *R. indica,* etc., are preferably used for extraction of rose oil and the making of gulkand and residual parts used as rose water. Among all the products, rose oil and gulkand are the most popular and demanding products due to their medicinal, fragrance and flavor value. It is also called rose petal jam or rose jam because the rose petals are preserved with sugar/honey/Jaggery/dry date fruit /coconut sugar and have a jam-like texture. Mostly, it is used as a laxative, tonic and flavoring purpose. The main objective of this review was to present the formulation, nutritional and medicinal value with health benefits of gulkand as it is prepared using high-value fresh rose petals and sugar with equal ratio (1:1) or different ratio (2:1) and is mainly manufactured in northern states of India. It has a rich nutraceutical value consisting of polyphenols, carbohydrates, dietary fibers, ash, vitamin C, etc. In Ayurveda, regular consumption of gulkand as a food supplement provides several health benefits and strengthens the body to fight excess heat, lethargy, muscular pain, improves eyesight and also provides relief in gastric and circulatory problems. Therefore, it is a safe and potent Ayurvedic preparation that plays a vital role in human nutrition and health and also creates self-employment opportunities.

Keywords: Gulkand, Rose petals, Sugar, Nutraceutical, Health benefits.

Introduction

Rose flowers are one of the most beautiful and charming creation of the nature which humans use for various purposes. It is considered to be the most valuable flower whose petals have natural color and flavoring properties along with pleasant aroma. They impart natural color, flavor and fragrance along with vital phytochemicals to the substrate (Kumar *et al*., 2017; Nadot and Carrive, 2020). Since ancient times in Greece, Roman, Indian Ayurveda and Unani systems, some edible flowers like roses have been used to enhance the taste, nutritional value and aesthetic appearance of food and beverages etc., (Kumar *et al*., 2020; Deepika *et al*., 2011). The edible flowers are considered to be harmless, non-toxic flowers as they do not cause any side effects when consumed and also have many health benefits (Bahuguna *et al*., 2020). Certainly, the awareness and attraction towards natural foods can be attributed to growing concerns about the excessive use of chemicals in conventional food production (Eyinade *et al*., 2021). People are increasingly recognizing the potential health risks associated with the consumption of food items that have been prepared and preserved using synthetic chemicals. This awareness is supported by various studies and reports highlighting the adverse effects of chemical residues created from synthetic preservatives, synthetic colors, synthetic fragrances and flavors on human health. Natural foods are safe to consume and provide a wide spectrum of nutrients that are essential for growth and development of the body (Eyinade *et al*., 2021; Netam, 2021). These foods have strong nutraceutical properties as well as valuable health benefits. There is a lot of literature available which have reported that edible flowers are the richest source of antioxidants, anti-carcinogens, vitamins, carotenoids and other valuable nutrients (Netam, 2021; Cicek *et al*., 2022). Some flowers like rose, calendula, wild pansy, tulip, lavender, marigold, periwinkle, hibiscus, sunflower and lotus, etc., are highly consumed for edible purposes throughout the world (de Lima Franzen *et al*., 2019). Among these flowers, Rose (*Rosa damascena*) (Figure 1), marigold (*Tagetes erecta*), lotus (*Nymphaea lotus*), hibiscus (*Hibiscus rosa-sinensis*), sunflower (*Helianthus annuus*),

Received: 10th May, 2024 Accepted: 09th September, 2024

*Corresponding author; Email: rksrivastava@cimap.res.in

and periwinkle (*Catharanthus roseus*), etc., are commonly used as major edible flowers in India (Kumar *et al*., 2020). Among these flowers, rose is one of the scenic creations of nature which is called the "Queen of Flowers." It is an ornamental shrub which is cultivated as cut flowers, loose flowers and is considered globally as a flower in high demand in the global market (Gamanagatti *et al*., 2014; Horibe *et al*., 2017). It is a member of the genus *Rosa* which belongs to the Rosaceae family (Labban and Thallaj, 2020). The genus *Rosa* contains more than 100 species of roses and also includes more than 18,000 cultivars which are mainly distributed in Europe, Asia, the Middle East, and North America, etc., (Naquvi *et al*., 2017; Desta *et al*., 2022). Several literatures have indicated that rose is native to Central Asia and it grows extensively in the temperate and subtropical Northern Hemisphere region (Desta *et al*., 2022; Tolekova *et al*., 2022). It is also reported that half of the rose species are found in Asia while one-fourth species are found in Europe and North America (Fougere-Danzen *et al*., 2015).

Formerly, rose has been admired as a natural treasure for its flowers, aroma, fruit and beauty (Batcaru *et al*., 2022). They are enriched in organic and inorganic nutrients, and hence, regular consumption of roses can replenish the essential nutrients required by the human body. They have many health benefits due to their high nutritional and medicinal value (Dan-min and Zhi-long, 2019). It has been reported that oil obtained from rose has properties to reduce pain, depression, nervous stress, headaches and nourishing the skin and beautifying the human body. Rose acts as an antioxidative, anti-ageing, anti-inflammatory, anticancer, antimicrobial, antibacterial and soothing agent which plays an important role in controlling skin diseases, and Alzheimer's diseases and also help to improve the function of the heart (Achuthan *et al*., 2022; Fathima *et al*., 2019; Markam, 2017). Rose petals are considered to be the most important part of the rose flowers as they have been utilized as a key ingredient in numerous medicinal and nutritional formulations including gulkand (Boskababy *et al*., 2011). Rose petals contain numerous bioactive compounds such as anthocyanins, flavonoids, glycosides, terpenes, carboxylic acids, vitamin C, kaempferol, quercetin and myrcene etc (Boskababy *et al*., 2011). It has been revealed that the major identified important chemical compounds of rose are β-citronellol, nonadecane, geraniol and nerol, etc., (Verma *et al*., 2011).

Figure 1: A close-up and field view of *R. damascena*

It has been reported that commercial cultivation of rose is done to obtain rose essential oil, rose water, fresh flowers, dried flowers, rose concrete, gulkand and rose absolute, etc., (Mohboubi *et al*., 2015).

Rose is considered to be the most valuable crop in floriculture, but its life is very short, which is not profitable for farmers and entrepreneurs, so nowadays to increase its shelf life and reduce post-harvest losses, it is used through value addition to create various value-added products (De, 2020). Many industries like food, cosmetics, perfumery and pharmaceuticals use rose flowers, rose petals, rose oil and rose water as raw material to produce many value-added products such as gulkand, rose sharbat, rose syrup, rose water and garland (rosary) etc., (De, 2020; Thirumalai and Sethupathi, 2022). In the food industry, rose petals were used to prepare jam, sharbat, sweets, vinegar, syrup and creams for cakes etc., (Batcaru *et al*., 2022). Gulkand is an old-age ayurvedic preparation considered to be one of the most important value-added products of rose (Figure 2). For a long period, it has been known as the most delicious herbal formulation derived from the great science of Ayurveda that has been traditionally used by mankind. The word gulkand is the combination of two Arabic words, gul meaning flower and kand meaning sweet/sugar (Nadaf *et al*., 2012). It has reported that rose petals of *R. centifolia, R. damascena, R. chinensis, R. pomifera, R. bourboniana* and *R. indica,* etc., and sugar in equal or different proportions are mixed and dried in sunlight for a period of 20 to 30 days to develop this delicious and nutritive gulkand (Jat *et al*., 2022). Among the various varieties of rose, *R. damascena* petals are extensively used in making gulkand.

Sugar is the next key ingredient of gulkand which is used as a sweetener and preservative to make it delicious to eat and also enhance the flavor and texture of the gulkand (Jat *et al*., 2022).

It is a natural, non-toxic, sweet testing and water-soluble crystalline carbohydrate. It has been reported that sugar is considered as a building block of carbohydrates and every one gram of sugar consumed provides 4000 calories. Generally, glucose, fructose sucrose, etc., are considered as common sugars (Zaitoun *et al*., 2018; Cummings *et al*., 1997). Honey is another popular source of natural sweetener which is a sweet jelly like natural flavoring product which is consumed as a medicine and food to strengthen the immunity and health of human beings. It contains glucose, fructose, sucrose, vitamins, organic acids, water and various minerals etc., (Subramanian *et al*., 2014; Alvarez-Suarez *et al*., 2014).

Nowadays, gulkand is consumed as a highly nutritious food and its demand in the market is increasing day by

Figure 2: A view of gulkand commonly available in the market

day. The manufacturing of gulkand is majorly practised in northern states of India such as Uttar Pradesh, where Kannauj being a major centre (Ayci *et al*., 2005; Tamrakr *et al*., 2020).

Preparation of gulkand

Gulkand from petals of R. damascena and R. centifolia

To develop gulkand, fresh rose flowers were collected from the local market of the Prayagraj. The petals were segregated to remove sepals and receptacles. The defective and injured petals were also sorted out, and then better petals were washed gently with clean water and confirmed that there were no waste materials, such as dust particles, etc., on them. Thereafter, petals were shade-dried for some time (30 minutes) and cut into small pieces, then shredded petals and sugars were taken in equal ratio, i.e., 1:1 ratio (w/w). A sterilized glass jar was taken, and petals and sugar were filled in it in layers. The filled jar was kept in a place where continuous sunlight was available. The heat of the sun would melt the sugar which would also mix with rose petals and due to continuous heat of the sun the petals would also slowly produce juicy secretion and thus they would be mixed well with the sugar. The primary or raw formulation needs to be given a stir every morning before placing it in sunlight for 2 to 3 weeks until the mixture becomes homogeneous. The color of the finished mixture was changed from bright pink to brownish with a semi-solid consistency. The prepared formulation was sweet, delicious and had a strong and pleasant aroma (Kanse *et al*., 2020).

Formulation for making of gulkand by using various natural sources of sugar

Gulkand was prepared as a dosage form of two ingredients, rose petals and natural sweeteners. Rose flowers were obtained from research farm and different natural sources of sugar like honey, coconut sugar, jaggery dry date fruits, etc., were purchased from the local super market. In this formulation, petals were tugged out gently from the flowers and then they were washed thoroughly with clean water and dried. Petals and natural sweeteners were filled in layers in a glass jar in different proportions (like 1:1,1:1.5,1:2). After this, each jar was covered with muslin clothes and labelled with a formulation name. The labelled jars were then placed in a hot air oven at 350 to 400^{o}C until all the sugars had melted and thoroughly mixed with the rose petals for the process of infusing sugars and other natural sugar substitutes into the rose petals and thus, formulations were ready (Ajai *et al*., 2022).

Preparation of rose petal jam from rose petals, sugar, lemon salt and water

In this formulation, fresh rose petals were sorted to remove sepals, receptacles and then cleaned with fresh running water to remove dirt and other contaminants. Thereafter, 200 g of rose petals, 25 g of lemon salt, 1 L of water and 1-kg of sugar were weighed and the weighed petals were mixed with the citric acid and left to get completely wet for 120 minutes. A large pan was taken to boil the water and sugar, then stir the boiling solution continuously. After this process, soaked rose petals were added to the boiling solution and boiled until the mass began to resemble gel. Approximately 30 to 45 minutes, the jam-like formulation was ready which was tested on a small saucer/plate to confirm its jam-like texture. Then the prepared mixture was allowed to cool. After this 1% of St. John's wort essential was added and mixed in rose petal jam, then the jam was transfer into hot sterilized jars, covered with a lid, labelled, and stored in a cool place (Bors *et al*., 2014).

Formulation of rose gulkand from fresh rose petals and honey

Freshly harvested rose flowers were collected from the local market. Inedible parts were removed from the flowers and infected, injured petals were also segregated and then discarded. Fresh rose petals were thoroughly washed in clean running water and ensured that there were no unwanted substances such as pollen grains, dust particles insect faeces, etc. Thereafter, the petals were dried in the shade with a clean rag to remove the moisture, then the petals were finely crushed. To prepare the primary mixture, 100 g of petals and 5 teaspoons of honey were taken and the ingredients were mixed until the right consistency was obtained. After this process, a clean and dry glass jar was taken and the prepared mixture was placed in it and the jar was closed with a lid, after which the packed mixture was exposed to direct sunlight for a proper formulation (Sao and Sharma, 2017).

Nutritional value of gulkand

Some research data have been published to find out the nutritional value of the gulkand. It contains a wide

Table 1: Nutritional value of gulkand in 100 g (Bors *et al*., 2014; Kanse *et al*., 2020)

S. No.	*Parameter*	*Value*
1	Protein	0.87 g
2	Total sugar	53.31 g
3	Fat	0.45%
4	Ash	4.86%
5	Vitamin C	37.40 mg
6.	Phenolic contents	16.65 mg

spectrum of nutritive substances such as sugar, protein, fat, ash, vitamin-C, iron, calcium and phenolic contents, etc., (Table 1). The reported moisture quantity of the formulation is found to be 69.85% (Bors *et al*., 2014; Sao and Sharma, 2017). It is completely free from bad cholesterol and unhealthy triglycerides. It has been estimated that the total calories are present per 10 g gulkand are 12 to 15 calories (Sao and Sharma, 2017).

Health benefits of gulkand

Apart from being used by home cooks and in professional nutrition, it is also considered as a medicine in Ayurveda. The National Institute of Ayurvedic Medicine has listed gulkand as having many health benefits, regular consumption of gulkand has the following health benefits (Jat *et al*., 2021):

Heat resistance

Interestingly**,** it is considered a leading remedy to control heat related illness. Since, it contains rose petals which have cooling properties and hence can be consumed as a cooling tonic. It cools to the body naturally by removing external and internal heat sensations of the body (Jat *et al*., 2021).

Reduce skin burning sensation

In summer, the heat generated due to direct exposure to the sun and continuous sunshine in summer can cause a burning sensation in the soles and palms. Since, the formulation is considered to be a heat-counteracting agent and hence its consumption gives relief from a burning sensation due to its natural cooling effect (Jat *et al*., 2021).

Powerful antioxidant

Rose petals contain some quantity of vitamin C which is a good antioxidant. Thus, this property is inherited in the formulation which reduces harmful free radicals in the body and prevents unnecessary cell damage and also refreshes the body by making human beings feel more refreshed (Jat *et al*., 2021).

Control hyperacidity

Hyperacidity means increased acid levels in the stomach**.** Rose petals have cooling properties and hence this formulation is also rich in this virtue which helps in reducing the increased levels of acid in the stomach (Nadaf *et al*., 2012).

Memory booster

Regular intake of gulkand is also helpful in maintaining brain health as well as improving memory (Mergal *et al*., 2023).

Blood purifier

Consuming gulkand due to its antioxidant properties helps in flushing out the harmful substances from blood and hence acts as a blood purifier and ultimately reduces the greasiness of the skin, clearing the pores and acne and providing natural glow (Mhetre *et al*., 2021).

Relief in fatigue, lethargy and pains

When people work continuously or travel for long distances they feel fatigue, lethargy muscular pains and sometimes itching in the muscles due to side effects of synthetic drugs. Consumption of gulkand provides immediate relief in all these conditions and also provides strength to the body to fight fatigue, lethargy, muscular pain and itching (Sardari *et al*., 2019).

Control problem of dysmenorrhoea

It has been reported that consumption of gulkand is beneficial in dysmenorrhoea or menstrual cramps in women (Parveen *et al*., 2020).

Improve the problem of fluid retention

It has a claimed effect on fluid retention or edema. It increases the rate of urination to solve the problem of fluid retention (Parveen *et al*., 2020).

Energy booster

When people do various or rigorous work in a day, their body becomes tired out due to loss of energy. Consumption of gulkand is very safe in such types of situations in comparison to other synthetic energy drinks, as consumption of 1 to 2 spoonfuls of gulkand naturally provides freshness and increases the energy of the body (Gupta *et al*., 2019).

Eye cure

Consuming gulkand daily improves eyesight and reduces the problem of conjunctivitis (Gupta *et al*., 2019).

Cure mouth ulcers

The cooling effect of gulkand also reduces the irritation and burning sensation in the mouth caused by mouth ulcers. (Sao and Sharma, 2011).

Prevent nosebleeds

It has been observed that the problem of nosebleeds is very common in children during the summer. Regular consumption of 1 to 2 spoons of gulkand also helps in reducing the problem of nosebleeds (Sao and Sharma, 2011).

Helps to control heart diseases

Gulkand is free from bad cholesterol and unhealthy triglycerides and hence its consumption helps to improve cardiac problems, hypertension etc. It also helps reduce uric acid levels in the blood and reduces the risk of arthritis due to the presence of ascorbic acid (Kanse *et al*., 2020).

Reduce stress

It has been reported that regular intake of gulkand can reduce stress by refreshing the mood (Davidson, 2013).

Uses of gulkand in processed food

The use of gulkand to prepare various processed products is discussed below:

Shrikhand

It is prepared by blending gulkand and rose petals with milk. Gulkand-flavored shrikhand helps to synthesize vitamin B complex in the human body and is also beneficial in stomach disease, obesity and circulatory system-related problems (Nadaf *et al*., 2012; Deshmukh *et al*., 2019).

Milkshake

Adding gulkand to milkshake makes it a delicious concoction with high nutritional value, taste and cooling properties which is beneficial for gastric problems (Nadaf *et al*., 2012).

Cake

Gulkand-flavored cake is an alternative source to regular cakes that is delicious and consumed as a health food as it has a low sugar content and is free from any side effects (Nadaf *et al*., 2012).

Pastries

Nowadays, gulkand is added to pastries to enhance their nutraceutical value, aesthetic appearance, taste and flavor (Nadaf *et al*., 2012).

Gelato ice cream

It has revealed that the gelato ice cream with gulkand shows an increase in its nutrients like carbohydrates, proteins, and vitamin C etc., compared to normal ice cream and its antioxidative property also increases (Kanse *et al*., 2020).

Flavored milk

It is a lightly processed product considered to be high in nutrients which is prepared by using cow's milk, gulkand, sugar, sodium alginate and rose flavor. It has been reported that flavored milk with a high percentage of gulkand has high quantities of total sugar and ash content while the moisture content, fat and protein levels are reduced. By consuming it the body gets refreshed and health improves (Mhetre *et al*., 2023; Mohammad *et al*., 2015)

Betel vine

It is an important processed product of gulkand which is consumed extensively in Chhattisgarh and other parts of India. Gulkand is used as a sweetener and preservative in the betel vine to improve the taste (Tamrakar *et al*., 2021).

Tea

Gulkand-flavoured tea is rich in nutrients such as minerals, carotenoids, vitamin C phenolic components, etc., and also imparts a powerful aroma and color to tea which is more beneficial for health in comparison to sugar-based tea (Mabellini *et al*., 2011).

Gulkand burfi

Gulkand rich burfi is developed by mixing milk and gulkand which has a low-fat content and can be consumed by people of all classes (Girase *et al*., 2017).

Fruit flavoured gulkand

It is a delicious and strong nutraceutical developed from a blend of rose petals, fruit pulp (Like Sapota) and other medicinal herbs and consumed as a food supplement to boost immunity and health (Patel *et al*., 2016).

Side effects of gulkand

Undoubtedly gulkand is an appetizing Ayurvedic preparation with high medicinal and nutritional value. It is very safe to consume without any side effects, but, when the proportion of sugar increases in the formulation can cause many health problems and thus it cannot be consumed by all human beings like a person with diabetes, whereas, this is the richest source of nutrients. To increase the consumption of gulkand, various natural sugar substitutes like honey, jaggery, dry date fruits, etc., are used in the formulation without compromising the standard physico-chemical and sensory properties (Ajai *et al*., 2022).

Conclusion

Gulkand was developed from fresh rose petals and sugar which is considered as value-added product of rose petals. The production of gulkand reduces postharvest losses of rose flowers and also increases the commercial viability of rose flowers. It is consumed as a safe nutraceutical natural product without any side effects which has rejuvenating and cooling properties. It consists of a broad range of nutrients such as carbohydrates, sugar, water, dietary fibres and vitamin C, etc. It is an energetic formulation having a good quantity of calories and its regular intake beats internal and external heat sensations during summer and also provides comfort in fatigue, lethargy and pains etc. The gulkand is acts as an antioxidative agent and hence inhibits the growth

of free radicals and stops unnecessary skin damage. It is used to prepare various flavoured dairy products such as shrikhand, flavored milk, ice-creams and also incorporated in betel vine, burfi, etc., because its natural flavoring properties. Thus, it is an eminent Ayurvedic nutraceutical product which can be made in home with fresh rose petals and sugar and consume throughout the year.

Authors Contribution

Conceptualization, design and quality improvement: Dr. Ramesh Kumar Srivastava, writing original draft: Ravi Kumar Shukla, Manuscript Analysis: Priyanka Singh and Vipin Kumar, Data collection: Ravi Prakash Verma, Editing of MS: Akshita Chakravarty. The content of the submitted manuscript was reviewed and approved by all the authors.

Conflict of Interest

The authors declare that they have no conflict of intrest.

Acknowledgments

Authors are thankful to Dr. Rajesh Kumar Verma P.I, CSIR-Floriculture Mission (HCP-0037) Phase-II for providing the financial support and also gratefully thanks to the Director CSIR-CIMAP for providing the research facilities and motivation. The Institutional manuscript communication number is CIMAP/Pub/2024/86.

References

Achuthan, C. R., Babu, B. H., & Padikkala, J. (2003). Antioxidant and hepatoprotective effects of *Rosa damascena*. *Pharmaceutical Biology, 41*(5), 357-361.

Afsari S., F., Mosleh, G., Azadi, A., & Mohagheghzadeh, A. (2019). Traditional and Recent Evidence on Five Phytopharmaceuticals from *Rosa damascena* Herrm. *Research Journal of Pharmacognosy, 6*(3), 77-84.

Ajai, T., Prasanth, P., Laxminarayan, D., & Kumar, P. S. (2022). Standardization of recipe for rose gulkand using natural sources of sweeteners. *The Pharma Innovation Journal, 11*(11), 2257-2262.

Alvarez-Suarez, J. M., Gasparrini, M., Forbes-Hernandez, T. Y., Mazzoni, L., & Giampieri, F. (2014). The composition and biological activity of honey: A focus on manuka honey. *Foods, 3*(3), 420-432.

Ayci, F., Aydinli, M., Bozdemir, O. A., & Tutas, M. (2005). Gas chromatographic investigation of rose concrete, absolute and solid residue. *Flavour and Fragrance Journal, 20*(5), 481-486.

Bahuguna, A., Vijayalaxmi, K. G., & Suvarna, V. C. (2018). Formulation and evaluation of fresh red Hawaiian hibiscus (*Hibiscus rosa-sinensis*) incorporated valued-added products. *International Journal of Current Microbiology and Applied Sciences, 7*(8), 4282-4290.

Bors, M. D., Petrut, G. S., Tofana, M., Socaci, S., & Farcas, A. (2014). Study regarding the production and characterization of rose petal jam enriched with Saint John's wort (*Hypericum perforatum*) essential oil. *Bulletin UASVM Food Science and Technology, 71*(1), 70-77.

Boskabady, M. H., Shafe, N. M., Saberi, Z., & Amini, S. (2011). Pharmacological effects of *Rosa damascena*. *Iranian Journal of Basic Medical Sciences, 14*(4), 295-307.

Butcaru, A. C., Stanica, F., & Velcea, & M. N. (2017). Preliminary studies regarding the production of jam from organic rose petal. *Bulletin UASVM Food Science and Technology, 74*(2), 50.

Cicek, H., Kaya, H. S., Kilic, C., Savas, M., & Ravichandran, S. (2022). Medicinal effects over products obtained from wild rose plant. *Journal of Chemistry and Nutritional Biochemistry, 3*(2), 59-64.

Cummings, J. H., Roberfroid, M. B., Anderson, H., Barth, C., Ferro-Luzzi, A., Ghous, Y., Gibney, M., Hermansen, K., James, W. P. T., Korner, O., Lauren, D., Pascal, G., & Vargen, A. G. S. (1997). A new look at dietary carbohydrates: Chemistry, physiology and health. *European Journal of Clinical Nutrition, 51*, 417-423.

Dan-min, F., & Zhi-long, Y. (2019). Development of rose and crab-apple compound beverage. In *E3S Web of Conferences*, 78.

Davidson, J. (2013). The magic of roses for cooking and beauty. JD-Biz Corp Publishing.

De, L. C. (2020). Value addition in flowers. *Vigyan Varta, 1*(3), 10-15.

De, L. F., F., Rodriguez de, O., M. S., Lidorio, H. F., Farias M., J., & Martins F. L. L. (2019). Chemical composition of rose, sunflower, and calendula flower petals for human food use. *Cienciay Tecnologia Auricularia, 20*(1), 149-168.

Deepika, S. D., Lakshmi, S. G., Sowmya, L. K., & Sulakshana, M. (2014). Edible flowers: A review article. *International Journal of Advanced Research in Science and Technology, 3*(1), 51-57.

Deshmukh, A. P., Padghan, P. V., & Shinde, S. P. (2019). Effect of rose petal powder on shelf life of shrikhand. *The Pharma Innovation Journal, 8*(9), 434-437.

Desta, B., Tena, N., & Amare, G. (2022). Response of rose (*Rosa hybrida* L.) plant to temperature. *Asian Journal of Plant and Soil Sciences, 7*(1), 93-101.

Eyinade, G. A., Mushunje, A., & Yusuf, S. F. G. (2021). The willingness to consume organic food: A review. *Food and Agricultural Immunology, 32*(1), 78-104.

Fathima, S. N., & Murthy, S. V. (2019). Pharmacognostic study of *Rosa damascena* petals. *Asian Journal of Pharmacy and Pharmacology, 5*(4), 779-785.

Fougere-Danezan, M., Joly, S., Bruneau, A., Gao, X. F., & Zhang, L. B. (2015). Phylogeny, biogeography, and polyploidy in wild roses with specific attention to polyploids. *Annals of Botany, 115*(2), 275-291.

Gamanagatti, P. B., Patil, B. L., Desai, M. N. R., Yeledhalli, R. A., & Dodamani, M. T. (2014). Protected cultivation technology (PCT) in Karnataka: An economic analysis of rose. *Research Journal of Agricultural Science*s, *5*(3), 559-563.

Girase, S. V., Gubbawar, S. G., Borse, N. S., & Khupse, S. M. (2017). Studies on preparation of gulkand burfi from buffalo milk. *Journal of Soils and Crops, 27*(2), 67-71.

Gupta, S., Patel, R., & Bhave, M. (2019). Development of a nutraceutical product using *Benincasa hispida*. *International Journal of Advance Research, Ideas and Innovations in Technology, 5*(1), 579-582.

Horibe, T., & Yamada, K. (2017). Petal growth physiology of cut rose flowers: Progress and future prospects. *Journal of Horticultural Research, 25*(1), 5–18.

Jat, R., Mahawer, L. N., Bairwa, H. L., Meena, R. H., Pilania, S., & Singh, M. (2021). Sensory evaluation and microbial analysis of rose petal jam. *The Pharma Innovation Journal, 10*(12), 3120-3124.

Jat, R., Mahawer, L. N., Bairwa, H. L., Pilania, S., Tak, J. K., & Singh, H. (2022). Impact of sugar, sugar candy, jaggery and honey levels on physico-chemical changes of bourbon rose petal jam at ambient storage. *International Journal of Plant & Soil Science, 34*(10), 27-36.

Kanse, S. A., Rani, R., Shanghai, S., & Chopde, K. D. (2020). Development of vitamin C and antioxidant-enriched artisanal gelato ice cream by incorporating gulkand. *Multilogic in Science, 10*(35), 1168-1173.

Kumar, A., Kaur, A., & Gill, K. (2017). Development and economics of artificial additives-free rose syrup from desi rose. *Indian Journal of Economics and Development, 13*(2a), 536–539.

Kumar, A., Kaur, A., Joshi, K. V., & Kumar, V. (2017). *Rosa damascena*: Quality evaluation and process optimization for the development of rose syrup. *International Journal of Food Fermentation Technology, 7*(2): 279-285.

Kumar, A., Kaur, A., Tomar, V., Gupta, K., & Kaur, K. (2020). Effect of rose syrup and marigold powder on the physiochemical, phytochemical, sensorial and storage properties of nutraceuticals and milk-based functional beverages. *Journal of the American College of Nutrition, 40*(2), 133-140.

Labban, L., & Thallaj, N. (2020). The medicinal and pharmacological properties of Damascena rose (*Rosa damascena*): A review. *International Journal of Herbal Medicine, 8*(2), 33-37.

Mabellini, A., Ohaco, E., Ochoa, M. R., Kesseler, A. G., Marquez, C. A., & Michelis, A. D. (2011). Chemical and physical characteristics of several wild rose species used as food or food ingredient. *International Journal of Industrial Chemistry, 2*(3), 158-171.

Mahboubi, M. (2016). *Rosa damascena* as holy ancient herb with novel applications. *Journal of Traditional and Complementary Medicine, 6*(1), 10-16.

Markam, S. (2017). Value addition of loose flowers. *International Journal of Home Science, 3*(1), 395-398.

Mergal, S., Tiwari, A., Rana, K., & Gujar, S. (2023). Preparation of pankand by using betal leaves (*Piper betle*) and damask rose (*Rosa damascena*) petals. *Journal of Emerging Technologies and Innovative Research, 10*(2), 546-555.

Mhetre, S., Andhare, B., & Deshmukh, A. (2021). Effect of gulkand on physico-chemical properties of the flavoured milk prepared by using gulkand. *The Pharma Innovation Journal, 10*(8), 1102-1105.

Mileva, M., Ilieva, Y., Jovtchev, G., Gateva, S., Zaharieva, M. M., Georgieva Dimitrova, L., Dobreva, A., Angelova, T., Vilhelmova-Ilieva, N., Valcheva, V., & Najdenski, H. (2011). Rose flowers—A delicate perfume or a natural healer? *Biomolecules, 11*(1), 127.

Mohammad, K., Rai, D. C., & Andhare, B. C. (2015). Effect of different nutraceuticals on physico-chemical quality of flavoured milk. *Research Journal of Animal Husbandry and Dairy Science, 6*(1), 61-65.

Nadaf, N. Y., Patil, R. S., & Zanzurne, C. H. (2012). Effect of addition of gulkand and rose petal powder on chemical composition and organoleptic properties of shrikhand. *Recent Research in Science and Technology, 4*(10), 52-55.

Nadot, S., & Carrive, L. (2020). The colourful life of flowers. *Botany Letters, 168*(1), 120-130.

Naquvi, K. J., Ansari, S. H., Ali, M., & Najmi, A. K. (2014). Volatile oil composition of *Rosa damascena* Mill. (Rosaceae). *Journal of Pharmacognosy and Phytochemistry, 2*(5), 177-181.

Netam, N. (2021). Edible flower cultivation: A new approach in floriculture industry. *The Pharma Innovation Journal, 10*(3), 857-859.

Parveen, R., Zahiruddin, S., Charegaonkar, A., Khale, A., & Mallick, S. (2020). Chromatographic profiling of rose petals in Unani formulations (gulkand, arq-e-gulab, rose sharbat) using HPTLC and GC-MS. *Journal of AOAC International, 103*(3), 684-691.

Patel, N. B., Vaghani, S. N., Sanghani, S. L., & Mayan, J. M. (2016). Study of physico-chemical properties of rose petal jam (gulkand) based on sapota. *Advances in Life Sciences, 5*(17), 7092-7096.

Sao, B., & Sharma, A. (2011). Rose gulkand: Treasure of health. *Vigyan Varta, 2*(5), 32-34.

Subramanian, R., Umesh Hebber, H., & Rastogi, N. K. (2014). Processing of honey: A review. *International Journal of Food Properties, 10*(1), 127-143.

Tamrakar, P., Sahu, T. L., & Parihar, N. (2020). Standardization of recipe for gulkand and evaluation of its physico-chemical characteristics during storage. *The Pharma Innovation Journal, 9*(12), 373-377.

Thirumalai, S. K., & Sethupathi. (2022). Formulation, standardization and shelf-life evaluation of *Rosa*

damascena sharbat using lime juice as natural preservative in different concentrations. *The Pharma Innovation Journal*, *11*(6), 2937-2942.

Tolekova, S., Sharmanov, T., Sinyavskiy, Y., Berzhanova, R., Mammadov, R., Aksoy, O. K., & Yusifli, R. (2020). Antioxidant, pharmacological, medical properties and chemical content of *Rosa* L. extracts. *International Journal of Secondary Metabolite, 7*(3), 200-212.

Verma, S. R., Padalia, C. R., & Chauhan, A. (2011). Chemical investigation of the volatile components of shade dried petals of damask rose (*Rosa damascena* Mill). *Archives of Biological Sciences, 63*(4), 1111-1115.

Zaitoun, M., Ghanem, M., & Harphoush, S. (2018). Sugars: Types and their functional properties in food and human health. *International Journal of Public Health Research, 6*(4), 93-99.