IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

ANTIOXIDANT ACTIVITY OF MANGO JELLY ENRICHED WITH PHYTOCHEMICALS FROM *Catharanthus roseus (PERIWINKLE FLOWER)*

[1]Shivangi Srivastava, [2]Dr. Priyanka Shankar
[1]M.Sc. Student, [2]Assistant Professor, Department of Food and Nutrition, School of Home Science, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India

Abstract

The aim of this study was to examine the antioxidant properties of mango jelly made from its pulp with the addition of bioactive compounds acquired from *Catharanthus roseus*. The scope of work included: preparation of jellies from obtained extract (which is pulp of mango), as well as analysis of the phytochemical and antioxidant activity of prepared jelly. The study showed that mango pulp can be a good option for utilizing the bioactive ingredients contained in periwinkle flower. The jellies made from the extract showed high antioxidant activity which was closely correlated with the amount of raw material used. In addition, the composition of bioactive compounds presented in the jelly like polyphenolic compounds which is antioxidants such as flavonoids, ascorbic acids, carotenoids and tocopherols.

- *Catharanthus roseus* is a good source of flavonoids alkaloids,saponin and terpenoids.
- Jelly enriched with *Catharanthus roseus* were characterized by high antioxidants level.

Keywords: Periwinkle flower (*Catharanthus roseus)*, Mango *(Mangifera indica*), phytochemicals, phytochemical analysis.

1. Introduction

As consumer awareness of nutrition is increasing day by day making it more and more important to pay attention towards health-enhancing foods. Therefore, consumers are increasingly willing to purchase food that contain more basic nutritive values, in addition to meeting their basic nutritional needs, i.e., the supply of portions of carbohydrates, proteins and fats, also has documented effects in terms of improving their well-being, health and reducing the risk of disease. Such foods are referred to as functional or enriched food.

For a long time, scientists have paid particular attention towards plant materials that have high content of substances with antioxidant properties, i.e., ascorbic acid, polyphenols, carotenoids and tocopherols. Many studies show that these compounds can protect the body from the adverse effects of oxidative stress. These oxidation of cell components e.g., proteins (including enzymes), lipids, DNA, lead to disturbances in its functioning, damage, and ultimately to its death. As a consequence, there are many civilisation diseases, i.e., cancer, neurodegenerative or cardiovascular diseases. There are various problems or diseases and, periwinkle flower are used as a treatment for that other than oxidative stress such as – Periwinkle alkaloids used in the treatment of leukaemia, malignant lymphomas, neuroblastoma, wilms tumour, mycosis fungoides, cerebral blood flow, treat high blood pressure and effective for diabetic patients as well.

It turns out that periwinkle flower is a good source of antioxidants. In traditional medicine, periwinkle flowers were valued for their therapeutic properties. To date, they are used to make tinctures, syrups, extracts, essential oils. *Catharanthus roseus* are a good source of ascorbic acid, polyphenolic compounds, especially flavonoids, terpenoids, and saponins. Vinca alkaloids are a subset of drugs obtained from the periwinkle plant. They are naturally extracted from the pink periwinkle plant, *Catharanthus roseus* have a hypo-glycemic as well as cytotoxic effects. They have been used to treat diabetes, high blood pressure and have been used as disinfectants. The vinca alkaloids are also important for being cancer fighters. There are four major vinca alkaloids in clinical use: **Vinblastine (VBL), Vinorelbine (VRL), Vincristine (VCR),** and **Vindesine (VDS).** These compounds, acting synergistically with each other, give periwinkle flower strong antioxidant and pharmacological properties, including expectorant, hypoglycemic, diaphoretic, antispasmodic and choleretic properties. Unfortunately, to date, there is little research into the potential use of periwinkle flower in the production of functional food.
The jelly is still a product eagerly purchased by consumers. Most often they are made by gelatinisation, using pectin, agar or gelatine, of a sugar base containing sucrose and corn syrup with the addition of flavourings, acids and dyes. However, high concentration of sugars and their low nutritional value mean that excessive consumption can cause dental cavities, obesity and hyperglycaemia. Reducing the proportion or complete substitution of sugars with other sweetening products, e.g., concentrated fruit juices, can make such jellies an alternative to traditional products of low nutritional value. Moreover, the addition of specific bioactive components may enhance the functionality of such products and their consumption could protect the human body from civilisation diseases.
The aim of this study was to examine the antioxidant properties of mango jelly made from mango pulp with the addition of bioactive ingredients acquired from periwinkle flowers.

2. Materials and methods

2.1. Extraction of antioxidants from periwinkle flower

2.1. Research material

The juice was obtained from periwinkle flower petals and was characterised by a green-coloured juice of 28°Brix, green colour and a light bitter taste and no smell. Periwinkle flower (*Catharanthus roseus*), 5–8 cm long, were harvested from 24 months -old plants from a nearby locality, in Babasaheb Bhimrao Ambedkar University (BBAU) located in Lucknow, Uttar Pradesh in April 2023. The Periwinkle flower were characterised by a typical shape, size and structure of the flower. No mould infection and no organic contamination.

2.2. Extraction of bioactive components and the method preparation of jellies

In order to obtain the extracts needed for the preparation of jelly, the extraction process was carried out at a temperature where the recovery of bioactive compounds from periwinkle flowers was maximal (60 °C, 120 min). Extracts were produced, using periwinkle flower of 5, 10 and 20% in relation to the weight of the extractant used. After the extraction process (120 min), the extracts were filtered through gauze.
The food pectin, which was added at 10 g per 100 mL of the mixture, was used to gel the extracts. The suspension was then heated to 85 °C and kept at that temperature for 5 min, then poured into jars and cooled to 10 °C.

2.3. Phytochemical Analysis ofMangoJelly Enriched withPeriwinkle Flower, Extract and Jelly

2.3.1. Vitamin C content

Phytochemical analysis was performed on final prepared extracts, jelly enriched with ingredients from periwinkle flower extracts. The determination of the vitamin C content consisted of extracting ascorbic acid from the sample with a solution of oxalic acid (2 g 100 mL^{-1}) and titration of the extract with a 2,6-dichlorophenolindophenol (DCPIP).

2.3.2. **The content of flavonoids**

ALKALINE REAGENT TEST:

Firstly, the sample for testing is prepared by diluting the prepared jelly in ethanol and then filtering it using filter paper. The prepared sample solution is yellow in colour.

Now for testing, In the prepared sample solution, dilute HCl (hydrochloric) acid is added and after sometime after observing the sample solution there is disappearance of colour which shows **alkaline reagent test positive (+)** which means there is presence of flavonoids.

2.3.3. **The content of alkaloids**

For alkaloid testing three tests were performed they are as follows: Hager's reagents test, Dragendorff 's reagent test and Wagner's reagent test.

2.3.3.1. **Hager's reagent test**

First of all, the sample is prepared using the sample and is diluted with ethanol and now the prepared sample solution is used for testing.

In the prepared sample solution Hager's reagent is added and after sometime it is observed there is no appearance of precipitate which shows the negative results of Hager's reagent test and hence shows absence of alkaloids.

2.3.3.2. **Dragendorff 's reagent test**

The same prepared sample solution used in Hager's reagent test is also used in this testing.

In the same prepared sample solution Dragendoff 's reagent is added and after sometime it is observed there is no appearance of orange precipitate which shows the negative results of Dragendoff 's reagent test and hence shows absence of alkaloids.

2.3.3.3. **Wagner's reagent test**

The same prepared sample solution is used in this testing also.

In the same prepared sample solution Wagner's reagent is added and after sometimes it is observed and there is no appearance of reddish – brown precipitate which shows negative results of Wagner's reagent test and hence shows the absence of alkaloids.

2.3.4. **The contents of tannin**

For this testing, first of all the sample is prepared. To prepare the sample solution, the sample is dissolved with distilled water and the sample solution is ready for testing.

Now for testing, In the prepared sample solution, ferric chloride solution is added and is observed after sometime there is no appearance of green colour and shows the negative results of this testing and hence shows there is absence of tannin in the prepared jelly.

2.3.5. **The content of saponin**

For this testing the sample solution is prepared by dissolving sample with distilled water and making the solution.

Now for the test, the prepared sample solution is continuously shake for 5 minutes and after sometimes there is appearance of foam which shows the positive results of this testing and hence shows the presence of saponin in the prepared jelly.

2.3.6. **The content of terpenoid**

For this testing, the sample solution is prepared by simply dissolving the sample in distilled water and the sample solution is ready to perform test.

Now for the test, in the prepared sample solution there is addition of 1ml of chloroform and concentrated sulphuric acid (H2SO4) and after sometime it is observed and there is appearance of reddish-brown colour, which shows the positive result of testing and shows the presence of terpenoids.

3. Results and discussion

3.1. The antioxidants composition of *Catharanthus roseus* and the effect of temperature on recovery of antioxidants from periwinkle flower

The first step of our research was to assess the content of selected antioxidant compounds present in periwinkle flower, which were first used to obtain the extract and then to prepare the jelly. In the course of the research, we showed that flavonoids constituted the dominant group of polyphenols, of which saponin, terpenoid and flavonoids showed the largest amount. In turn, the vitamin C level was 181.7 mg 100 g^{-1}. The above-mentioned a high content of polyphenols and vitamin C resulting in high antioxidant activity.

The efficiency of the process of extracting phytochemicals from plant raw materials depends on many factors, including the type and quantity of solvent or osmotic agent, the degree of grinding of the raw material, extraction time, intensity of mixing and temperature. However, in the case of plants rich in ascorbic acid and phenolics, the limiting factor is temperature. According to many studies, increasing the extraction temperature intensifies mass exchange process, generating greater recovery of bioactive ingredients, but too high a temperature may contribute to the degradation of these compounds.

3.2. The content of selected phytochemicals in jelly enriched with bioactive ingredients from periwinkle flower

Most often, the biological value of food is improved by the addition to the product of bioactive ingredients, in the form of dried and powdered plant parts, oils or more or less purified extracts, at various stages of the manufacturing process. In our work, the basis for the preparation of jellies was an extract containing bioactive ingredients from young pine shoots obtained from osmotic drainage utilized concentrated apples juice.

Periwinkle flower in relation to the mass of the extractant used. The jellywell formed, uniform and yellow in colour, jiggly and uniform in fracture, dry surface, glossy and gel-like and elastic consistency and the desired flavour. Moreover, a change in the intensity of the colouring was observed depending on the proportion of extract from periwinkle used in the extraction mixture. The higher the proportion of extract, the darker the colour of the jellies.

The next step tested the antioxidant activity and the content of selected bioactive ingredients in the jelly. As expected, increasing the proportion of periwinkle flower in the extraction mixture increases the vitamin C content, polyphenolic compounds, including phenolic acids and flavonoids, as well as the total antioxidant activity in the final product. The addition of young pine shoots at 20% generated an increase of 150% in ascorbic acid level, 98% in total phenolics level, and 173–178% in antioxidant activity (DPPH-ABTS). This is in line with most

scientific reports assessing the effect of doses of exogenous antioxidants, both in the form of extracts and parts of plants, on the total antioxidant activity of the finished product.

The effectiveness of the extraction of phytochemicals from *periwinkle flower* has been also confirmed, using chromatographic methods. Research showed that all dominant polyphenolic and volatile compounds from periwinkle were present in the final product. However, we did not find the presence of the remaining polyphenols in the jelly which were identified in the periwinkle flower, probably due to their too low concentration in relation to the proportion of periwinkle flower in the extraction mixture or limited solubility in final product. Interestingly, fortified jellies were characterised by a reduced content of polyphenols derived from the juice. This was probably due to thermal degradation of these substances and/or the formation of complexes of polyphenols with macromolecules from periwinkle flower, e.g., proteins and polysaccharides, which could then be removed during extract filtration.

So far, few studies have been published focusing on the use *of Periwinkle flower (Catharanthus roseus)* and other species of this genera, in the production of functional food. The study assessed antioxidant and antiproliferative activity against colon cell carcinoma (Caco-2) of pineapple juices and red fruit enriched with commercial periwinkle plant extract from *Catharanthus roseus*. Like us, the authors showed a significant increase in polyphenol levels in fortified products, as well as an increase in polyphenol levels in juices. Moreover, the enrichment of the juices with bioactive ingredients enhanced the anti-proliferative effect of the juices in relation to Caco-2. López-Nicolás et al. (2014) found that these juices with the addition of extract demonstrated the ability to inhibit growth of pathogenic enteric bacteria, i.e., *Escherichia coli* and *Enterococcus faecalis*. An increase in levels of vitamin C, polyphenols and anti-oxidative activity was also noted in orange juice enriched with extracts from C. *brutia*, C. *pinea* and a preparation of Pynocgenol (extract of *C. pinaster*) (Celiktas et al., 2010).*Catharanthus roseus* The research of other authors also showed that the addition of bioactive compounds from periwinkle causes modification of the technological properties of the enriched products. Semeniuc et al. (2016) obtained periwinkle bud syrup by boiling, maceration for 48 h and boiling with sugar, which they then added to kefir after fermentation in the amounts of 2, 4, 6, 8 and 10%. The authors found an increase in dry matter, a decrease in fat, protein and pH in the final product, together with an increase in the percentage of extract. In turn Ahn et al. (2002) showed that *C. pinaster*, *Catharanthus roseus* extract improved the oxidation stability of ground heat-treated beef, which was observed by a lower level of lipid peroxidation products reacting with thio-barbituric acid, and a lower content of hexanal during storage.

4. Conclusions

The study showed that mango juice, and periwinkle flower can be a good medium for osmotic drainage of bioactive components contained in periwinkle flower. However, the recovery efficiency of these components is dependent on the process temperature. The most efficient extraction of selected phytochemicals can be achieved by conducting the process at 60 °C. The jelly prepared based on extract showed high antioxidant activity which was closely correlated with the amount of raw material used. In addition, the bioactive compounds present in the jellies reduced the level of oxidative stress. Introducing such jellies as part of a balanced diet can improve the health of consumers, especially by jelly reducing the negative effects of oxidative factors. The use of only natural ingredients during preparation of such jelly should significantly increase the interest of this product as a functional food.

References:

1. I. Ben Rejeb, N. Dhen, S. Kassebi, M. Gargouri

Quality evaluation and functional properties of reduced sugar jellies formulated from citrus fruits. Journal of Chemistry, 2020 (2020), 10.1155/2020/5476872.

2. H. Cory, S. Passarelli, J. Szeto, M. Tamez, J. Mattei
The role of polyphenols in human health and food systems: A mini- review Frontiers in Nutrition, 5 (2018).

3. M. Dziedziński, J. Kobus-Cisowska, D. Szymanowska-Powałowska, K. Stuper-Szablewska, M. Baranowska

Polyphenols composition, antioxidant and antimicrobial properties of *Pinus sylvestris* L. shoots extracts depending on different drying methods
Emirates Journal of Food and Agriculture, 32 (3) (2020).

4. M. Dziedzinski, J. Kobus-Cisowska, D. Szymanowska, K. Stuper-Szablewska, M. Baranowska

Identification of polyphenols from coniferous shoots as natural antioxidants and antimicrobial compounds

Molecules, 25 (15) (2020).

5. L.E. Figueroa, D.B. Genovese

Fruit jellies enriched with dietary fibre: Development and characterization of a novel functional food product

LWT - Food Science and Technology, 111 (2019).

6. A. Gramza-Michalowska, J. Regula

Use of tea extracts (*Camelia sinensis*) in jelly candies as polyphenols sources in human diet
Asia Pacific Journal of Clinical Nutrition, 16 (SUPPL.1) (2007).