



Phytochemical Study of Mango Seed Kernels (*Mangifera indica* L.)

Dr. Amol D. Desai¹, Dr. Umakant N. Rabb²

¹Assistant professor of Dept of Kayachikitsa Dr.S.P.Patil Ayurvedic medical College, Korochoi -Ichalkaranji
Maharashtra india

²Professor Dept of Dravyaguna Vigyan B.G Garaiya Ayurvedic Medical College Kalipat Rajkot Gujarat
India

Corresponding Author: Dr. Amol D. Desai

ABSTRACT:

Introduction- Mango seed kernels are an underutilized agro industrial by-product generated during mango processing. Despite being discarded as waste, they contain various biologically active phytochemicals with potential pharmaceutical and nutraceutical importance. This study investigated the qualitative and quantitative phytochemical composition of mango seed kernels using methanolic and aqueous extracts to evaluate their antioxidant potential and possible industrial applications.

Materials and Methods- Fresh mango seeds were collected, cleaned, dried, and powdered. The kernel powder was extracted separately with methanol and distilled water using the maceration method. Standard phytochemical screening tests were performed to detect alkaloids, flavonoids, tannins, saponins, phenols, glycosides, and terpenoids. Total phenolic content was estimated using the Folin Ciocalteu method, while total flavonoid content was determined by aluminum chloride colorimetric assay. Spectrophotometric analysis was used for quantitative measurements.

Results- The qualitative analysis confirmed the presence of alkaloids, flavonoids, tannins, phenols, glycosides, saponins, and terpenoids in both extracts. Methanolic extracts showed comparatively higher concentrations of phytochemicals than aqueous extracts. Quantitative estimation revealed significant amounts of total phenolic and flavonoid compounds, indicating considerable antioxidant activity. The elevated phenolic content suggested strong free radical scavenging potential and enhanced bioactive properties of mango seed kernels.

Discussion- The findings demonstrate that mango seed kernels are a rich source of phytochemicals with promising antioxidant potential. The higher extraction efficiency of methanol indicates its suitability for recovering bioactive compounds. The presence of phenolics and flavonoids supports the potential use of mango seed kernels in pharmaceutical, nutraceutical, and functional food industries. Utilization of this agro-industrial waste may also contribute to environmental sustainability and value-added product development. Further studies involving compound isolation, toxicity assessment, and in vivo antioxidant evaluation are recommended to validate therapeutic efficacy and support commercial utilization. The study highlights the importance of converting agricultural waste into economically beneficial resources with potential health promoting properties for product innovations.

KEYWORDS: Mango seed kernel, phytochemicals, flavonoids, phenolics, antioxidant activity, *Mangifera indica*

INTRODUCTION

Plants have long served as valuable sources of biologically active compounds that contribute significantly to human health and nutrition. These naturally occurring compounds, commonly referred to as phytochemicals, are secondary metabolites synthesized by plants for defense and survival. Phytochemicals possess a broad range of biological activities including antioxidant, antimicrobial, anti-inflammatory, antidiabetic, anticancer, and cardioprotective^[16] effects. Due to these therapeutic properties, plant-derived compounds are increasingly being explored for pharmaceutical, nutraceutical, cosmetic, and food industry applications. Among tropical fruits, *Mangifera indica* L. (mango) is one of the most widely cultivated and consumed fruits worldwide because of its pleasant flavor, aroma, and nutritional value. Global mango processing industries generate substantial quantities of by-products such as peels and seeds, which are generally discarded as agro-industrial waste. Mango seeds account for approximately 10–25% of the total fruit weight, and the seed kernel constitutes nearly 45–75% of the seed. Although often considered waste material, mango seed kernels are rich reservoirs of bioactive compounds and nutrients. Recent scientific investigations have demonstrated that mango seed kernels contain significant amounts of polyphenols, flavonoids, tannins, saponins, alkaloids, glycosides, terpenoids, steroids, and fatty acids. These phytochemicals contribute to the remarkable medicinal properties associated with mango seed extracts. In particular, phenolic compounds and flavonoids are recognized for their strong antioxidant activity, which helps neutralize free radicals and reduce oxidative stress. Oxidative stress is closely linked with the development of chronic diseases such as cancer, diabetes mellitus, cardiovascular disorders, and neurodegenerative diseases. Therefore, natural antioxidants derived from plant materials have gained considerable attention as safer alternatives to synthetic antioxidants. Several studies have also reported that mango seed kernel extracts exhibit antimicrobial activity against a variety of pathogenic microorganisms including bacteria and fungi. The antimicrobial effect is mainly attributed to the presence of tannins, phenolic acids, and flavonoids that interfere with microbial cell walls and metabolic processes. In addition, mango seed kernels have shown anti-inflammatory, antidiabetic, antihyperlipidemic, and anti-obesity properties, indicating their potential role in disease prevention and health promotion. The kernel oil extracted from mango seeds is rich in stearic and oleic acids and has potential applications in food products, cosmetics, and pharmaceutical formulations. Despite these promising properties, mango seed kernels remain largely underutilized and are commonly discarded during industrial processing, contributing to environmental pollution and waste management problems. The valorization of mango seed kernels through phytochemical exploration^{[11],[6]} and bioactive compound extraction could provide an economical and sustainable approach for developing value-added products. Utilizing these waste materials may also contribute to environmental sustainability and support circular bioeconomy practices in the agro processing industry. Extraction solvents play a crucial role in isolating phytochemicals^[15] from plant materials because the polarity of solvents influences the type and quantity of compounds extracted. Methanolic extracts are often reported to contain higher concentrations of phenolic compounds and flavonoids due to the strong solubility of these compounds in methanol, whereas aqueous extracts are considered safer and more suitable for food and medicinal applications. Comparative analysis of methanolic and aqueous extracts helps determine the most effective extraction method for obtaining biologically active constituents from mango seed kernels. Therefore, the present study was undertaken to perform qualitative and quantitative phytochemical screening of mango seed kernels using methanolic and aqueous extracts. The study aimed to identify major bioactive constituents^[13] such as alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and phenolic compounds, as well as to evaluate their antioxidant potential^[12]. By investigating the phytochemical profile and biological significance of mango seed kernels, this research seeks to highlight their possible pharmaceutical, nutraceutical, and industrial applications. The findings of this study may encourage the utilization of mango

seed kernel waste as a valuable natural source of therapeutic compounds and contribute to the development of sustainable plant-based products.

MATERIALS AND METHODS

Collection of Sample ^[7]- Fresh ripe mango fruits were collected from a local market in Rajkot. The seeds were separated from the pulp, washed thoroughly with distilled water, and air-dried for several days.

Preparation of Mango Seed Kernel Powder-

The outer seed coat was manually removed to obtain the kernels. The kernels were sliced into small pieces and dried in a hot air oven at 50-60°C for 48 hours. The dried material was ground into fine powder using a laboratory grinder and stored in airtight containers for further analysis.

Extraction Procedure-

Approximately 50 g of powdered sample was soaked in 250 mL of methanol for 72 hours with intermittent shaking. The extract was filtered using Whatman No. 1 filter paper and concentrated using a rotary evaporator. The concentrated extract was stored at 4°C until further use.

Qualitative Phytochemical Screening ^{[2],[4],[5]}-

Standard phytochemical tests were carried out to identify the presence of major bioactive compounds.

Table No-1

SL NO	BIOACTIVE COMPOUNDS	TESTS	OBSERVATIONS	RESULTS
1.	Alkaloids	Mayer's test	Cream precipitate	Present
2.	Flavonoids	Alkaline reagent test	Yellow coloration	Present
3.	Tannins	Ferric chloride test	Blue-black color	Present
4.	Saponins	Foam test	Stable froth	Present
5.	Phenols	Ferric chloride test	Dark blue coloration	Present
6.	Glycosides	Keller–Killiani test	Brown ring formation	Present
7.	Terpenoids	Salkowski test	Reddish-brown layer	Present

RESULTS AND DISCUSSION

- Qualitative phytochemical screening ^{[10],[11]} was performed using standard biochemical methods to determine the presence of important secondary metabolites in the plant extract. Phytochemicals are naturally occurring bioactive compounds produced by plants, and they play a vital role in defense mechanisms as well as therapeutic activities. The screening process helps in identifying the medicinal value and pharmacological significance of plant materials by detecting various chemical constituents responsible for biological activities.
- The results of the phytochemical analysis revealed the presence of several major bioactive compounds ^[14], including alkaloids, flavonoids, tannins, saponins, phenols, glycosides, and terpenoids. The detection of these compounds suggests that the plant extract possesses significant medicinal potential and may exhibit various biological properties ^{[8],[9]} such as antioxidant, antimicrobial, anti-inflammatory, anticancer, and cardioprotective activities.

Alkaloids-

- Alkaloids were identified using Mayer's test. The formation of a cream-colored precipitate confirmed the presence of alkaloids in the extract. Alkaloids are nitrogen-containing organic compounds widely distributed in medicinal plants. They are known for their diverse pharmacological effects, including analgesic, anti-malarial, antibacterial, antihypertensive, and anticancer activities. Many therapeutic drugs derived from plants belong to the alkaloid group, making their presence highly significant in phytochemical studies.

Flavonoids

- Flavonoids were detected through the alkaline reagent test, where the appearance of a yellow coloration indicated a positive result. Flavonoids are polyphenolic compounds recognized for their strong antioxidant potential. They protect cells and tissues against oxidative stress caused by free radicals and reactive oxygen species. In addition to antioxidant activity, flavonoids possess anti-inflammatory, antiviral, antimicrobial, antidiabetic, and anticancer properties. Their presence in the extract suggests the plant may help in preventing oxidative damage and chronic diseases.

Tannins

- The ferric chloride test produced a blue-black coloration, confirming the presence of tannins. Tannins are high molecular weight polyphenolic compounds that exhibit astringent properties. They play an important role in wound healing and protection against microbial infections. Tannins are also known for their antioxidant and anti-inflammatory activities. The ability of tannins to precipitate proteins contributes to their antimicrobial action by inhibiting the growth of bacteria and fungi.

Saponins

- Saponins were detected using the foam test, where the formation of stable froth indicated a positive result. Saponins are glycosidic compounds with soaplike characteristics due to their surfactant properties. They are known to possess antimicrobial, antifungal, anti-inflammatory, cholesterol lowering, and immune stimulating activities. Saponins can also enhance nutrient absorption and contribute to the therapeutic effectiveness of medicinal plants.

Phenols

- Phenolic compounds were confirmed through the ferric chloride test by the development of a dark blue coloration. Phenols are important plant metabolites widely known for their antioxidant potential. They help in neutralizing harmful free radicals, thereby reducing oxidative stress and preventing cellular damage. Phenolic compounds also exhibit antimicrobial, anti-inflammatory, antimutagenic, and anticancer activities. Their presence indicates that the plant extract may possess strong protective effects against various diseases.

Glycosides

- Glycosides were identified by the Keller–Killiani test, which showed the formation of a characteristic brown ring. Glycosides are compounds consisting of a sugar molecule attached to a non-sugar component. They are known for their wide range of pharmacological activities, particularly in cardiovascular therapy. Certain glycosides exhibit cardiotonic properties and are used in the treatment of heart-related disorders. Additionally, glycosides may possess antimicrobial, antioxidant, and anti-inflammatory effects.

Terpenoids

- The Salkowski test confirmed the presence of terpenoids through the formation of a reddish-brown layer. Terpenoids are one of the largest classes of plant secondary metabolites and are responsible for the aroma, flavor, and medicinal properties of many plants. They exhibit numerous biological activities

such as anti-inflammatory, antiviral, antibacterial, antimalarial, and anticancer effects. Terpenoids are also known to contribute to the plant's defense mechanism against environmental stress and pathogens.

CONCLUSION

- The qualitative phytochemical screening demonstrated that the plant extract contains a wide spectrum of bioactive compounds with significant medicinal importance. The presence of alkaloids, flavonoids, tannins, saponins, phenols, glycosides, and terpenoids indicates that the extract possesses considerable pharmacological potential. These phytochemicals may work individually or synergistically to produce therapeutic effects such as antioxidant, antimicrobial, anti-inflammatory, anticancer, and cardioprotective activities. Therefore, the plant can be considered a valuable natural source of bioactive constituents and may serve as a promising candidate for further pharmacological and pharmaceutical investigations.

ACKNOWLEDGMENT

- The authors would like to express their sincere gratitude to the President of the College, Mr. Vanrajibhai Garaiya, Shri Rambhai Garaiya, and Shri Abhalbhai Garaiya for their constant support and for providing the necessary institutional and laboratory facilities. The authors are especially thankful to the Principal, Dr. Mahesh Kundagol, for his valuable guidance and encouragement throughout the work.

REFERENCES

1. Alisha Prakash et al journal of integrated medical sciences march 2024/ vol9/ issue 3 page no-245-248.
2. World Health Organization. Quality control methods for medicinal plant materials, World Health Organization, 1998.
3. Indian Pharmacopoeia Commission. Indian Pharmacopoeia. Ghaziabad.
4. Evans WC. Trease and Evans pharmacognosy. 16th Edition. London: Saunders Elsevier; 2009.
5. Kokate CK, Purohit AP, Gokhale SB. Practical pharmacognosy. 5th Edition. Pune: Nirali Prakashan; 2014.
6. Lim TK. Edible medicinal and non medicinal plants. Dordrecht: Springer; 2012.
7. World Health Organization. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. World Health Organization; 2003.
8. World Health Organization. WHO guidelines for assessing quality of herbal medicines with reference to contaminants and residues. World Health Organization; 2007.
9. Ministry of AYUSH. The Ayurvedic pharmacopoeia of India. New Delhi: Government of India. 247 World Journal of Pharmaceutical Science and Research Volume 5, Issue 3, 2026 www.wjpsronline.com
10. World Health Organization. Quality control methods for herbal materials. Geneva: World Health Organization; 2011.
10. Shah B, Seth AK. Textbook of pharmacognosy and phytochemistry. 2nd Edition. New Delhi: Elsevier; 2010.
11. Mukherjee PK. Quality control and evaluation of herbal drugs. New Delhi: Business Horizons; 2002.
12. Indian Drug Manufacturers' Association. Indian herbal pharmacopoeia. Mumbai: IDMA.
12. Mango butter for anti aging skin care pure and coco <https://share.google/hfxwultvL8jumz19>.

13. Soong, Y. Y., & Barlow, P. J. (2004). Antioxidant activity and phenolic content of selected fruit seeds. *Food Chemistry*, 88(3), 411-417.
14. Ajila, C. M., Naidu, K. A., Bhat, S. G., & Rao, U. J. S. P. (2007). Bioactive compounds and antioxidant potential of mango peel extract. *Food Chemistry*, 105(3), 982-988.
15. Dorta, E., González, M., Lobo, M. G., Sánchez-Moreno, C., & de Ancos, B. (2012). Screening of phenolic compounds in tropical fruits. *Food Chemistry*, 135(3), 1949–1954.
16. Ediriweera, M. K., Tennekoon, K. H., & Samarakoon, S. R. (2017). Mango seed kernel phytochemistry and therapeutic applications. *Evidence-Based Complementary and Alternative Medicine*, 2017, 1-11.