INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

Research Article

Comparative Evaluation of Anthelmintic Activity of Hydroalcoholic Extracts of *Carica papaya* Seeds in Different Solvent Ratio

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ARTICLE INFO

Published: 21 Jun 2026
Keywords:
Carica papaya, Anthelmintic activity, Hydroalcoholic extract, Pheretima posthuma, Herbal medicine
DOI:
10.5281/zenodo.20790945

ABSTRACT

Helminth infections are a common health problem, especially in developing countries, and can lead to malnutrition, anemia, and poor growth. Although drugs such as albendazole are effective, concerns about side effects and drug resistance have increased interest in plant-based treatments. Carica papaya (papaya) seeds are traditionally used to treat worm infections because they contain beneficial compounds such as alkaloids, flavonoids, saponins, and glycosides. In this study, hydroalcoholic extracts of papaya seeds prepared using 50:50 and 80:20 ethanol-water ratios were evaluated for anthelmintic activity against Pheretima posthuma earthworms. The results showed that both extracts were effective, but the 80:20 extract performed better, producing a higher extraction yield (24%) and faster paralysis and death of worms. These findings suggest that Carica papaya seeds have promising anthelmintic properties and may serve as a natural alternative for managing helminth infections.

INTRODUCTION

Helminth infections are among the most common parasitic diseases affecting humans and animals worldwide. These infections are caused by parasitic worms including nematodes, cestodes, and trematodes. According to the World Health Organization, billions of people are at risk of helminth infections, especially in tropical and subtropical regions where poor sanitation and hygiene contribute significantly to disease transmission. Helminthiasis is associated with numerous health complications such as malnutrition, anemia, abdominal discomfort, intestinal obstruction, impaired growth, and reduced cognitive performance, particularly among children

For many decades, synthetic anthelmintic drugs such as albendazole, mebendazole, levamisole, and pyrantel pamoate have been widely used for the treatment and control of worm infestations.

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Although these drugs are effective, their extensive use has led to concerns regarding the development of drug resistance. Furthermore, some synthetic medications may produce undesirable side effects including nausea, vomiting, headache, abdominal pain, and gastrointestinal disturbances. These limitations have encouraged researchers to search for safer, cost-effective, and naturally derived alternatives.

Medicinal plants have been an integral part of traditional healthcare systems for centuries. They contain diverse bioactive compounds that exhibit a wide range of pharmacological activities. Herbal medicines are generally considered safer and more affordable than synthetic drugs and are often readily available in rural communities. As a result, medicinal plants have become an important area of research in the development of alternative therapeutic agents.

Carica papaya L., commonly known as papaya, belongs to the family *Caricaceae* and is cultivated extensively throughout tropical and subtropical regions of the world. The plant is valued not only for its nutritional benefits but also for its medicinal properties. Various parts of the plant, including the leaves, fruits, roots, latex, and seeds, have been used traditionally to treat several diseases and disorders.

Papaya seeds are particularly rich in phytochemicals and have attracted considerable scientific interest because of their antiparasitic, antimicrobial, antioxidant, and anti-inflammatory activities. The seeds contain alkaloids, flavonoids, glycosides, saponins, proteins, fixed oils, and proteolytic enzymes such as papain and chymopapain. These constituents are believed to contribute to the anthelmintic activity of the seeds by affecting the metabolism, neuromuscular system, and protective cuticle of parasitic worms.

The extraction process plays a crucial role in obtaining biologically active compounds from medicinal plants. Different solvent systems extract different classes of phytochemicals depending on their polarity. Hydroalcoholic solvents containing ethanol and water are commonly used because they can efficiently extract both polar and semi-polar constituents. Therefore, evaluating different ethanol-water ratios is important for optimizing extraction efficiency and biological activity.

The present study was undertaken to compare the anthelmintic activity of hydroalcoholic extracts of *Carica papaya* seeds prepared using 50:50 and 80:20 ethanol-water solvent systems. The study also aimed to investigate the phytochemical profile and extraction yield of the prepared extracts. The earthworm Pheretima posthuma was selected as the experimental model because of its physiological similarity to human intestinal helminths. infections are among the most common parasitic diseases and are responsible for significant morbidity worldwide. These infections can lead to malnutrition, anemia, weakness, and impaired growth, especially in children. Although synthetic drugs such as albendazole are effective, long-term use has contributed to drug resistance and adverse effects.

Medicinal plants have emerged as valuable sources of bioactive compounds. *Carica papaya* is widely recognized for its nutritional and therapeutic importance. Papaya seeds contain alkaloids, flavonoids, saponins, glycosides, proteins, and proteolytic enzymes that contribute to their medicinal value. Traditional systems of medicine have long utilized papaya seeds to treat intestinal worm infestations.

This research focuses on comparing two hydroalcoholic extraction systems to identify the most efficient solvent ratio for extracting active constituents responsible for anthelmintic activity.

MECHANISM OF ACTION

The anthelmintic activity of *Carica papaya* seeds is due to the combined action of several naturally occurring phytochemicals. Each compound acts in a different way to weaken and eliminate parasitic worms.

- Alkaloids (Carpaine): These compounds affect the nervous system of worms, causing paralysis and making them unable to move or survive.
- Flavonoids: They interfere with the parasite's energy production, reducing its ability to carry out normal metabolic functions.
- Saponins: Saponins damage the worm's cell membrane, causing leakage of important cellular components and ultimately leading to its death.
- Glycosides: These compounds disrupt the normal physiological activities of parasites and enhance the overall anthelmintic effect.
- Proteolytic Enzymes (Papain and Chymopapain): These enzymes break down proteins present in the protective outer covering of worms, causing structural damage and making them more vulnerable.
- Fixed Oils and Fatty Acids: They may weaken or damage the outer surface of worms and support the action of other active constituents.

Together, these phytochemicals act synergistically by paralyzing the worms, disrupting their metabolism, damaging their protective structures, and eventually causing their death. This combined effect contributes to the significant anthelmintic activity of *Carica papaya* seeds.

ADVANTAGES

1. Utilizes a natural and easily available medicinal plant.

2. Provides a cost-effective alternative to synthetic anthelmintic drugs.

3. Demonstrates the importance of solvent selection in extraction efficiency.

4. Supports traditional medicinal use of papaya seeds.

5. Identifies potential herbal sources for future drug development.

6. Uses a simple and reproducible extraction method.

7. Shows concentration-dependent biological activity.

8. Encourages research into plant-based therapies for parasitic diseases.

LIMITATIONS

1. The study was conducted only in vitro using earthworms.

2. Human clinical studies were not performed.

3. The active compounds responsible for activity were not isolated.

4. Long-term toxicity studies were not conducted.

5. Standardization of extract composition remains necessary.

6. Results may vary with geographical source and quality of plant material.

7. Further pharmacological and pharmacokinetic studies are required.

NEED OF THE STUDY

Helminth infections continue to affect millions of people, especially in developing countries where poor sanitation and limited healthcare facilities increase the risk of parasitic worm infestations. These infections can cause various health problems, including malnutrition, anemia, weakness, and impaired growth in children. Although synthetic anthelmintic drugs are commonly used for treatment, their prolonged use may lead to drug resistance and unwanted side effects.

Medicinal plants have gained attention as safer, cost-effective, and easily available alternatives. *Carica papaya* seeds have been traditionally used in folk medicine for treating intestinal worms and are known to contain several bioactive compounds with potential anthelmintic properties. However, scientific evidence regarding the effect of different extraction solvents on their activity is limited.

Therefore, this study was undertaken to evaluate and compare the anthelmintic activity of hydroalcoholic extracts of *Carica papaya* seeds prepared using different solvent ratios. The findings may help identify an effective natural source for the development of herbal anthelmintic formulations and contribute to the search for safer alternatives to conventional drugs.

MATERIALS AND METHODS

1) Collection of Plant Material

Mature seeds of *Carica papaya* were collected, washed thoroughly with water, and shade dried for several days. The dried seeds were pulverized into coarse powder and stored in airtight containers until further use

2) Preparation of Hydroalcoholic Extracts

Two hydroalcoholic solvent systems were prepared:

1. Ethanol: Water (50:50)
2. Ethanol: Water (80:20)

The powdered seed material was subjected to maceration with each solvent system for 72 hours with intermittent shaking using an orbital shaker. The extracts were filtered through Whatman filter paper and concentrated using a water bath. The concentrated extracts were weighed to determine percentage yield.

3) Determination of Percentage Yield

Percentage yield was calculated using the formula:

Yield (%) = (Weight of Extract / Weight of Powdered Drug) × 100

4) Preliminary Phytochemical Screening

The extracts were screened for:

- Alkaloids
- Flavonoids
- Saponins
- Glycosides
- Proteins

- Tannins

Using standard pharmacognostic procedures.

5) Anthelmintic Activity

Experimental Model:

Pheretima posthuma earthworms were used because of their anatomical and physiological similarity to intestinal helminths.

Test Solutions:

- Albendazole (Standard)
- Hydroalcoholic Extract (50:50)
- Hydroalcoholic Extract (80:20)

Concentrations Tested:

1. 10 mg/mL
2. 25 mg/mL

The time required for paralysis and death of worms was recorded.

RESULTS

Table 1. Percentage Yield of Hydroalcoholic Extracts

Sr. No.	Solvent Ratio	% Yield
1	50:50	17.4%
2	80:20	24%

The 80:20 ethanol-water extract produced a higher percentage yield, suggesting more efficient extraction of bioactive constituents.

Table 2. Phytochemical Screening

Sr. No.	Constituent	50:50	80:20
1	Alkaloids	Present	Present
2	Saponins	Present	Present
3	Tannins	Absent	Absent
4	Glycosides	Present	Present
5	Flavonoids	Present	Present
6	Proteins	Present	Present

Both extracts showed similar phytochemical profiles, indicating that differences in activity are likely related to extraction efficiency rather than the presence or absence of constituents.

Table 3. Anthelmintic Activity

Test Solution	Ratio	Conc. mg/mL	Paralysis Time	Death Time
Albendazole	-	10	21 min 40 sec	39 min 19 sec
Albendazole	-	25	17 min 11 sec	32 min 33 sec
Extract	50:50	10	23 min 48 sec	49 min 12 sec
Extract	50:50	25	22 min 12 sec	42 min 01 sec
Extract	80:20	10	22 min 20 sec	45 min 57 sec
Extract	80:20	25	18 min 40 sec	37 min 44 sec

DISCUSSION

The results demonstrate a clear concentration-dependent anthelmintic effect. Increasing extract concentration reduced both paralysis and death times. The 80:20 extract consistently performed better than the 50:50 extract and produced results close to albendazole

The improved activity of the 80:20 extract may be attributed to enhanced extraction of alkaloids and flavonoids, which are known to affect parasite metabolism and neuromuscular function. The synergistic action of multiple phytochemicals likely contributes to the observed biological activity.

CONCLUSION

The present study demonstrated that hydroalcoholic extracts of *Carica papaya* seeds possess significant anthelmintic activity against Pheretima posthuma. Among the two solvent systems evaluated, the 80:20 ethanol-water extract exhibited a higher extraction yield (24%) compared to the 50:50 extract (17.4%), indicating superior extraction efficiency.

Preliminary phytochemical screening confirmed the presence of important bioactive compounds including alkaloids, flavonoids, saponins, glycosides, and proteins in both extracts. These phytochemicals are known to contribute to anthelmintic activity through paralysis and destruction of worms.

Both extracts showed concentration-dependent activity, with the 25 mg/mL concentration producing better results than the 10 mg/mL concentration. The 80:20 extract demonstrated stronger anthelmintic activity and produced paralysis and death times that were closer to those of the standard drug albendazole.

Therefore, it can be concluded that *Carica papaya* seed extract, particularly the 80:20 hydroalcoholic extract, represents a promising natural source of anthelmintic agents and may have potential for the development of herbal formulations for the treatment of helminth infections.

The study confirms that *Carica papaya* seed extracts possess significant anthelmintic activity. Among the tested solvent systems, the 80:20 ethanol-water extract showed superior extraction yield and stronger biological activity. These findings support the traditional use of papaya seeds and highlight their potential as a natural, affordable alternative for the management of helminth infections.

REFERENCES

1. Azwanida NN. A review on the extraction methods used in medicinal plants: Principle, strength and limitation. Med Aromat Plants. 2015;4(3):196.
2. Krishna KL, Paridhavi M, Patel JA. Review on nutritional, medicinal and pharmacological properties of Carica papaya. Nat Prod Radiance. 2008;7(4):364–373.
3. Aravind G, Bhowmik D, Duraivel S, Harish G. Traditional and medicinal uses of Carica papaya. J Med Plants Stud. 2013;1(1):7–15.
4. Bose BC, Saifi AQ, Vijayvargiya R, Bhagwat AW. Pharmacological studies on Carica papaya seeds with special reference to their anthelmintic action. Indian J Med Sci. 1961;15:888–892.
5. Ajaiyeoba EO, Onocha PA, Olarenwaju OT. In vitro anthelmintic properties of medicinal plant extracts. Pharm Biol. 2001;39(3):217–220.
6. Dash GK, Suresh P, Kar DM, Ganpaty S, Panda SB. Evaluation of anthelmintic activity of various plant extracts. J Nat Remedies. 2002;2(2):182–185.

7. Singh O, Ali M. Phytochemical and antifungal profiles of Carica papaya seeds. Indian J Pharm Sci. 2011;73(4):447–451.
8. Ocloo FCK, Bansa D, Boatin R, Adom T, Agbemavor WS. Comparative evaluation of the in vitro anthelmintic effects of Carica papaya seed extracts. J Trop Med. 2020;2020:1–7.
9. Cabral ERM, Moraes D, Levenhagen MA, Costa-Cruz JM. Ovicidal and larvicidal activity of Carica papaya seed extract against helminths. Rev Inst Med Trop Sao Paulo. 2019;61:e43.
10. Jadhav SS, Hasabe RY, Shikalgar SA, Patil VS. Evaluation of phytochemical screening and anthelmintic activity of Carica papaya seed extract. Int J Sci Res. 2023;12(6):1210–1214.
11. Singh K, Sharma P, Gaur A, Parihar HR. Anthelmintic activity of aqueous and alcoholic extracts of Carica papaya seeds. Asian J Dairy Food Res. 2023;42(2):235–240.
12. An-Nisa S, Putri SA, Affandi ML, Pawestri AR. Promising anthelmintic properties of papaya extract: A literature review. J Kedokt Brawijaya. 2024;36(1):45–52.
13. Stepek G, Buttle DJ, Duce IR, Behnke JM. Human gastrointestinal nematode infections: Are new control methods required? Int J Exp Pathol. 2006;87(5):325–341.
14. World Health Organization. Soil-transmitted helminth infections [Internet]. Geneva: World Health Organization; 2024 [cited 2026 Jun 9]. Available from: [https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections] (https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections)
15. Adebiyi A, Adaramoye OA, Adeyemi OS, et al. Phytochemical composition, toxicity assessment, and antioxidant potential of ethanolic extract of Carica papaya seeds. Cureus. 2023;15(11):e49686.

HOW TO CITE: Aniket Raje Ghadage, Ajinkya Shelmkar, Aditya Thorat, Dr. Prashant Misal, Dr. R. R. Bendgude, Comparative Evaluation of Anthelmintic Activity of Hydroalcoholic Extracts of Carica papaya Seeds in Different Solvent Ratio, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 6, 5546-5552. https://doi.org/10.5281/zenodo.20790945