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Research Paper

Therapeutic Potential and Anthelmintic Activity of Bottle Gourd Peel

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ABSTRACT

The primary aim of the research is to examine the in-vitro anthelmintic and therapeutic potential of bottle gourd (*Lagenaria siceraria*) peels on helminths. To determine the anthelmintic activity of the dry bottle gourd peels against the Earthworm, Roundworm, and Tapeworm, they were subjected to blends of hexane, dichloromethane, chloroform, ethyl acetate, and water extracts of the peels. The study was conducted by employing a bioassay with different concentration levels (10, 20, 30, 40, and 50 mg/mL) of each extract, as the time of paralysis and time of death of the worms were observed. As a standard of reference, Albendazole was employed. The hexane extract of bottle gourd had higher rates of paralysis and mortality of worms, especially at low concentrations, compared to the rest of the extracts. Chloroform extract was least active compared to all the extracts. Albendazole mainly performs its action on the worms by preventing microtubular functioning

INTRODUCTION

The helminths are parasitic worms. They are more widespread infectious agents of human beings in

the developing world and cause a significant burden of being an infectious disease that surpasses other more established infections, such

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as malaria and tuberculosis. The prevailing phyla of helminths are two:

1. The nematodes (roundworms), e.g., filarial worms, intestinal worms, and *Onchocerca volvulus*,
2. Platyhelminthes (flatworms), e.g., tapeworms, schistosomes, and flukes [1].

Today, they disproportionately affect marginalized, low-income, and resource-constrained regions of the world [2]. In this time of rapidly expanding helminth disease and the commitment to finding a drug to control it is essential that resources are allocated in an efficient manner to have the greatest impact. However, many questions remain regarding how best to select a good drug, which is one of the great challenges worldwide for researchers, including the development of synthetic or natural remedies with low side effects [3]. Unfortunately, there are only a limited number of drug classes available for anthelmintic activity in the market, and substantial resistance has been developed in most of the parasitic species. Thus, the synthesis of various anthelmintics with a broad spectrum of action is necessarily important. The drug development may be either synthetic or natural [4]. The activity of any anthelmintic medication is to either deaden or kill the worm and expel it from the body. A portion of the usually accessible medications are albendazole, piperazine, mebendazole, levamisole, and thiabendazole [5,6]. A most popular marketed drug, albendazole, showed good anthelmintic activity either in-vitro or in-vivo in humans primarily against helminth species. However, it is effective against the major intestinal species infecting humans [7]. In spite of this, albendazole shows hepatotoxicity along with hepatic failure in a few cases, as reported in the literature [8]. In comparison with synthetic drugs, natural compounds exhibit a greater tendency to show anthelmintic properties in the treatment of various parasitic diseases. This review focuses on

the ability of plant-based natural products in the development of new therapeutic compounds for their anthelmintic activity [9]. Natural compounds in plants have medicinal effects, which are still being explored to derive novel pharmaceuticals [10]. Plant waste, such as leaves, seeds, peels, stems, and roots can be utilized after harvesting [11]. Through this, researchers have found an easy source of antioxidant, antihypertensive, anti-obesity, anticancer, antidiabetic, and antibacterial agents [12]. Bottle gourd is a versatile crop that belongs to the cucurbit family and is mainly found in sub-Saharan Africa (SSA) for human consumption [13]. Bottle gourd (*Lagenaria siceraria*) shows more genetic inconsistencies and morphological activities compared to other plants in the cucurbit family [14,15]. One of the most common and widespread worm infections is helminthiasis, which is very harmful to the human body [9]. Bottle gourd is mainly used as a nourishing agent, cardio-protective, diuretic, and cardio-tonic [16]. It also possesses both antihepatotoxic activity [17] and antioxidant activity [18]. There are many literature surveys that have revealed that *Lagenaria siceraria* shows good anthelmintic activity based on the fruit, seed, etc. [19]. Therefore, the present study is carried out based on the bottle gourd peels that perform the anthelmintic activity.

2. METHODS

2.1. Drugs and chemicals

The solvents were procured from SD Fine Chem Ltd. and Avra Synthesis Pvt Ltd., Mysore, India. Moreover, all other chemicals used in this study were of analytical grade with high purity.

2.2. Collection and identification of the plant:

Newly grown bottle gourd was used for the experimental purpose from the area of Mandya district, Karnataka, India. The collected fruits were



first washed thoroughly with water to remove dirt and then peeled off the skin manually, and then kept for drying under the sun for 10 days. After complete drying, the entire portions were crushed into a coarse powder with the help of a grinding machine and were stored in an airtight container for further use.

2.3. Extraction and solvent-solvent partitioning of plant material:

Plant powder was prepared by packaging 20g of *Lagenaria siceraria* in filter paper and loading it into the thimble, which is placed inside the Soxhlet extractor. Following this, the solvents (250 mL of hexane, dichloromethane, chloroform, ethyl acetate, and water) were added to a round-bottom flask, which was attached to a Soxhlet extractor and condenser on an isomantle. The solvent was heated using the isomantle at a boiling point of hexane (69.1°C), dichloromethane (39.6°C), chloroform (61.2°C), ethyl acetate (77.1°C), and water (100°C). And it started evaporating, passing through the apparatus to the condenser. The condensate dripped then into the reservoir containing the thimble. Once the level of solvent reached the siphon, it was poured back into the

flask and the cycle began again. The process should run for about 10 hours. After extraction, the content was concentrated on a water bath for the removal of solvents from samples by using a rotary evaporator apparatus.

2.4. Preparation of Plant Extracts

Medical plants are useful in both fresh and dry forms. Drying is the most common preservation procedure that occurs post-harvest, which requires prompt execution to uphold quality, prevent contamination, and the deterioration of phytochemical properties. The desiccated plant matter was crushed into small fragments between 2-5 mm using a cylindrical crusher. Approximately 100 g of resinous plant dry powder was placed within a Soxhlet apparatus for solvent extraction, subjected to extraction of solvents, stating sequential extraction from non-polar solvent to polar solvent, i.e., hexane. The extraction samples were preserved at a temperature of 4°C for subsequent analyses. The filtrates were later filtered through Whatman No. 1 filter paper and further concentrated by the use of a rotary evaporator to eliminate the solvents.

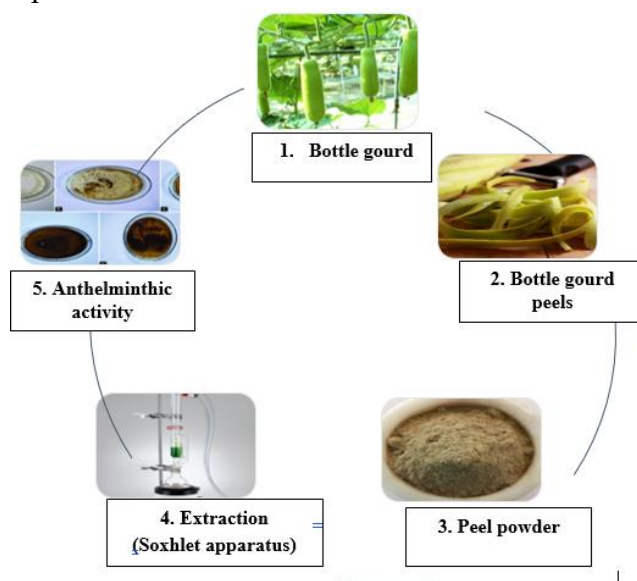


Figure 1 – Highlighting the process of study

These concentrated extracts were refrigerated in glass flasks fitted with screw plastic lids, and were appropriately labelled as bottle gourd hexane extract (BH), bottle gourd dichloromethane extract (BD), bottle gourd chloroform extract (BC), bottle gourd ethyl acetate extract (BE), and bottle gourd water extract (BW).

2.5. Experiment on animals:

An in-depth study was performed to investigate the effective anthelmintic potential of different extracts of bottle gourd peel powder using hexane,

dichloromethane, chloroform, ethyl acetate, and water extracts. These extracts have been stringently tested at various levels of concentration, ranging from 10 to 50 mg/mL, with an accurately planned bioassay. This bioassay precisely determined not only the critical time of death of earthworms, roundworms, and tapeworms but also the time period it took for paralysis of worms. It is notable that the reference used for comparison was made by an anthelmintic agent, albendazole.



2.6. RESULT AND DISCUSSION

In our present study, preliminary examination of various extracts of bottle gourd fruit has revealed its anthelmintic effects. The study revealed that all the fruit extracts had varying levels of positive anthelmintic activity. The method of extraction involved transitioning from non-polar solvents to polar solvents, allowing for the separation of non-polar and polar compounds within the different extracts of bottle gourd fruit, while also examining their respective biological activities. Furthermore,

we conducted the experiment to obtain more compounds in polar and non-polar extracts, such as hexane, dichloromethane, ethyl acetate, chloroform, and water. We subjected the extract to thin-layer chromatography using various mobile phases, one of which was hexane: dichloromethane. The hexane extract, in particular, demonstrated greater potency at a lower concentration of 10 mg/mL against *A. galli* (roundworm). To evaluate the anthelmintic activity, we used a reference (albendazole) as shown in **Table 1**.

Table 1: Comparative anthelmintic activity of various bottle gourd peel extracts versus albendazole (standard drug).

Groups	Conc. (mg/mL)	<i>Pheretima posthuma</i> (Earthworm)		<i>Ascaridia galli</i> (Roundworm)		<i>Cestoda</i> (Tapeworm)	
		Time taken for Paralysis (P) in mins (Mean & SEM)	Time taken for Death (D) in mins (Mean & SEM)	Time taken for Paralysis (P) in mins	Time taken for Death (D) in mins (Mean & SEM)	Time taken for Paralysis (P) in mins	Time taken for Death (D) in mins (Mean & SEM)

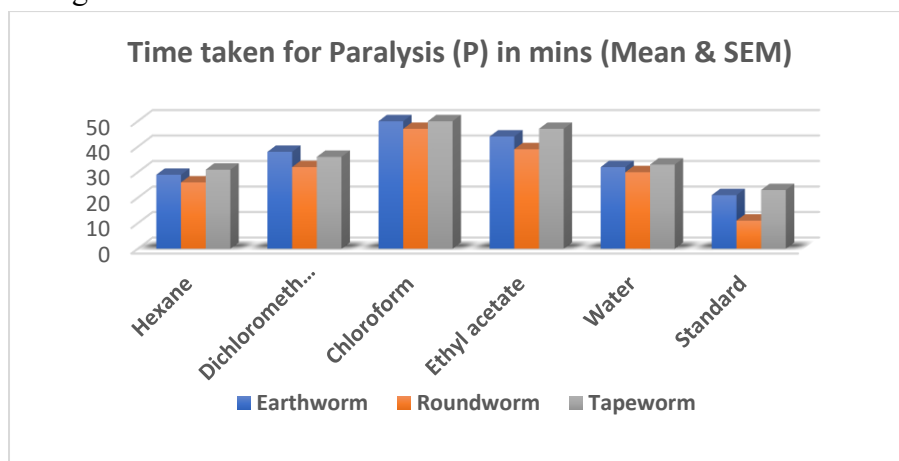
				(Mean & SEM)		(Mean & SEM)	
Hexane extract	10	29±0.39	49±0.21	26±0.34	50±0.41	31±1.49	55±1.49
	20	24±0.11	44±0.27	21±0.74	50±0.30	23±0.39	44±0.51
	30	17±0.43	29±0.61	14±0.17	38±0.49	19±1.61	39±1.09
	40	16±0.30	29±0.10	13±0.83	37±1.19	18±0.49	39±0.49
	50	15±0.43	27±0.24	10±0.36	35±1.11	17±0.72	38±1.19
Dichloro methane extract	10	38±0.98	54±0.55	32±0.95	52±0.45	36±1.82	55±1.44
	20	30±0.22	50±0.48	29±0.96	45±0.32	29±0.51	49±0.55
	30	20±0.58	38±0.88	21±0.41	40±0.45	20±1.71	39±1.45
	40	19±0.54	31±0.34	17±0.54	33±1.19	18±0.35	37±0.32
	50	17±0.35	28±0.25	16±0.56	42±1.35	24±0.93	39±1.22
Chloroform extract	10	50±0.94	60±0.66	47±0.47	65±0.67	50±1.58	68±1.59
	20	46±0.87	58±0.65	41±0.97	59±0.72	41±0.77	58±0.59
	30	39±0.74	49±0.65	34±0.74	43±0.53	38±1.46	41±1.54
	40	29±0.65	50±0.55	28±0.86	47±1.33	32±0.67	53±0.65
	50	25±0.78	37±0.66	25±0.78	50±1.46	30±0.48	55±1.88
Ethyl acetate extract	10	44±0.80	58±0.59	39±0.93	60±0.58	47±1.86	57±1.52
	20	40±0.34	48±0.43	31±0.67	42±0.42	37±0.56	42±0.51
	30	27±0.68	35±0.72	27±0.61	38±0.46	25±1.78	33±1.33
	40	22±0.56	36±0.43	24±0.74	39±1.29	28±0.55	40±0.62
	50	18±0.36	29±0.47	19±0.56	46±1.45	28±0.84	43±1.53
Water extract	10	32±0.42	52±0.31	30±0.54	58±0.55	33±1.52	61±1.52
	20	27±0.12	46±0.38	25±0.88	52±0.39	25±0.41	47±0.62
	30	21±0.55	32±0.78	18±0.21	40±0.53	21±1.72	42±1.16
	40	20±0.51	33±0.25	15±0.91	41±1.25	20±0.53	41±0.52
	50	19±0.45	31±0.35	13±0.48	36±1.25	20±0.83	41±1.25
Control (Water only)	-	-	-	-	-	-	-
Albendazole (standard)	10	21±1.09	58±0.72	11±1.41	36±1.09	23±0.46	50±1.09

The hexane extract of bottle gourd represented higher rates of paralysis and mortality of worms, especially at lower concentrations, in comparison to other extracts. It was noteworthy that the ethyl acetate extract displayed significant activity, while the chloroform extract was the least active of all the extracts. The primary mode of action of albendazole on the worms is the inhibition of microtubular function. With a lesser amount of bottle gourd peel extract, it not only exhibits paralysis but also presents the death of the worms. Albendazole, a most common and widely used broad-spectrum anthelmintic, a standard reference

drug in numerous experimental investigations, is associated with a number of adverse effects well documented in human beings. The use of albendazole treatment has been reported to cause gastrointestinal disturbances, which include abdominal pain, nausea, and vomiting, and CNS manifestations, which include headache and dizziness [20,21]. More severe toxicities were observed, particularly with long-term exposure and increased doses, such as hepatotoxicity manifested by increased hepatic transaminases, bone marrow suppression that results in leukopenia or pancytopenia, alopecia, and in rare

cases, hypersensitivity reactions [21-23]. Owing to such safety concerns, it is predetermined that the use of albendazole requires strict dose regulation and routine liver function and hematological evaluations. In contrast, natural plant-based extracts under investigation for their anthelmintic

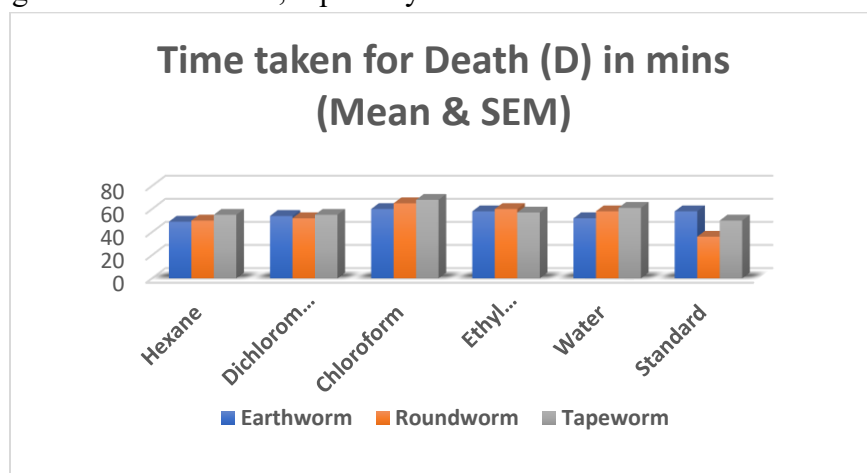
effects are more likely to be considered a safer alternative, due to a long history of traditional usage with pronounced pharmacological impact and minimal or no adverse effects at therapeutic concentrations [24,25].



Graph 1 – Representing the time taken for Paralysis (P) in mins (Mean & SEM) in Earthworm, Roundworm, and Tapeworm using various bottle gourd peel extracts against standard (Albendazole).

The conspicuous absence of significant toxicity with regard to these natural extracts highlights the prospects of having safer anthelmintics, especially

when used for long-term administration and on more susceptible populations.



Graph 2 – Representing the time taken for Death (D) in mins (Mean & SEM) in Earthworm, Roundworm, and Tapeworm using various bottle gourd peel extracts against standard (Albendazole).

Considering the established safety issues regarding albendazole, especially its dose-effect and prolonged adverse effects, a comparative experimental design was adopted, which justified the use of higher concentrations of plant-derived extracts. Owing to this, the bottle gourd peel extracts were tested at a concentration of 50

mg/mL, considering their natural origin and reported minimal toxicity, as compared to albendazole, which was used at a lower concentration of 10 mg/mL in the estimation due to its known side-effect profile. This approach allowed the comparison of anthelmintic efficacy between a standard drug and the test extracts to be

done in a balanced and ethically appropriate method, taking into consideration the differential safety margins of the test extracts and standard drug. Therefore, plotting graphs depicting the time taken for paralysis and death following treatment with various bottle gourd peel extracts (50 mg/mL) and standard albendazole (10 mg/mL) against earthworms, roundworms, and tapeworms revealed that the time taken for paralyzing and death was significantly faster with the extracts compared to albendazole. The hexane extract exhibited strong anthelmintic efficacy compared to other extracts, implying a strong and broad-spread anthelmintic potential against a wide range of helminth taxa. Thus, we can conclude that the extracts are much more effective than albendazole for anthelmintic activity.

CONCLUSION

The traditional use of the fruit of bottle gourd as an anthelmintic has been confirmed using the different extracts, and it showed significant anthelmintic activity. It indicates that the ethyl acetate extract is more potent compared to other extracts, as it took less time to cause paralysis and death of the earthworms compared to the standard reference drug. As part of our ongoing work for the search of new drugs, we are focusing on both synthetic and natural products. Keeping in mind such outstanding properties exhibited by this plant, the present study was intended to investigate the anthelmintic activity of different extracts of bottle gourd fruit on various worms.

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REFERENCES

1. Peter J. Hotez, Paul J. Brindley, Jeffrey M. Bethony, Charles H. King, Edward J. Pearce, and Julie Jacobson, Helminth infections: the great neglected tropical diseases, *Journal of Clinical Investigation*, 2008, 118, 1311–1321.
2. Hotez PJ, Molyneux DH, Fenwick A, Kumaresan J, Sachs SE, Control of neglected tropical diseases, *New England Journal of Medicine*, 2007, 357, 1018–1027.
3. Hugo C. Turner, James E. Truscott, T. Déirdre Hollingsworth, Alison A. Bettis, & Simon J. Brooker. Cost and cost-effectiveness of soil-transmitted helminth treatment programmes: systematic review and research needs, *Parasites & Vectors*, 2015, 8 ,1-23.
4. K. L. T. Dilrukshi Jayawardene, Enzo A. Palombo, and Peter R. Boag, Natural Products Are a Promising Source for Anthelmintic Drug Discovery, *Biomolecules*, 2021; 11, 1457.
5. J Horton, Albendazole: a review of anthelmintic efficacy and safety in humans, *Parasitology*, 2000, S113-32.
6. Kalpesh B. Ishnava & Priya S. Konar, In vitro anthelmintic activity and phytochemical characterization of *Corallocarpus epigaeus* (Rottler) Hook. f. tuber from ethyl acetate extracts, *Bulletin of the National Research Centre*, 2020, 44, 33.
7. M. Albonico, Q. Bickle, M. Ramsan, A. Montresor, L. Savioli, & M. Taylor, Efficacy of mebendazole and levamisole alone or in combination against intestinal nematode infections after repeated targeted mebendazole treatment in Zanzibar, *Bulletin*

- of the World Health Organization, 2003, 343-352.
8. Jose Fabio Freire, Lopasso Maria Carolina Rocha, Lopes Gabriel Lima, Pereira Renner Augusto Raposo, Subfulminant Acute Liver Failure by Albendazole: Case Report, *Journal of Medical Cases*, 2015, 342-345.
 9. Fares Hezam Al-Ostoot, Shaukath Ara Khanum, Yasser Hussein Eissa Mohammed, Syed Zabiulla, Therapeutic potential and in vitro anthelmintic activity of ridge gourd fruit, *Asian Journal of Pharmaceutical and Clinical Research*, 2019, 309-312.
 10. Noohi Nasim, Inavolu Sriram Sandeep and Sujata Mohanty, Plant derived natural products for drug discovery: current approaches and prospects, *Nucleus*, 2022, 65, 399-411.
 11. Panzella L, Moccia F, Nasti R, Marzorati S, Verotta L, Napolitano A, Bioactive phenolic compounds from agri-food wastes: An update on green and sustainable extraction methodologies, *Frontiers in Nutrition*, 2020, 7, 60.
 12. Cynthia E. Lizárraga-Velázquez, Nayely Leyva-López, Crisantema Hernández, Erick Paul Gutiérrez-Grijalva, Jesús A. Salazar-Leyva, Idalia Osuna-Ruíz, Emmanuel Martínez-Montaño, Javier Arrizon, Abraham Guerrero, Asahel Benitez-Hernández and Anaguiven Ávalos-Soriano, Antioxidant Molecules from Plant Waste: Extraction Techniques and Biological Properties, *Processes*, 2020, 8, 1566.
 13. Ganesh G. Dhakad, Kaveri P. Tambe, Sangita P. Shirsat, Neha R. Jaiswal, Review on Study of Bottle Gourd on Human Health. *Research Journal of Pharmacology and Pharmacodynamics*, 2022, 14, 174-178.
 14. A.F.M. Jamal Uddin, M.I. Tahidul, M.S.N. Chowdhury, I.H. Shiam, H. Mehraj, Evaluation of bottle gourd (*lagenaria siceraria*) to growth and yield, *International Journal of Biosciences*, 2014, 5, 7-11.
 15. Aman Upaganlawar and Ramchandran Balaraman, bottle gourd (*lagenaria siceraria*) “A vegetable food for human health”- a comprehensive review, *Pharmacology online*, 2009, 1, 209-226.
 16. Thube Smita, Tambe Rashmi, Patel Mohammed Farooque, Patel Sakil Daud, In-vitro anthelmintic activity of seed extract of *lagenaria siceraria* (Molina.) standley fruit, *Journal of pharmacy research*, 2009, 2, 1194-1195.
 17. A.Shirwaikar, K.K. Sreenivasan. Chemical investigation and Antihepatotoxic activity of the fruits of *Lagenaria siceraria*, *Indian Journal of Pharmaceutical Sciences*, 1996, 58, 197-202.
 18. S. Jiwjinda, V. Santisopasn, A. Murakam, O.K.Kim, H.W. Kim, H.Ohigashi. Suppressive effects of edible Thai plants on super oxide and NO generation, *Asian Pacific Journal Cancer Prevention*. 2002, 3, 215-223.
 19. Rakesh P. Prajapati, Manisha Kalariya, Sachin K. Parmar, and Navin R. Sheth, Phytochemical and pharmacological review of *Lagenaria siceraria*, *Journal of Ayurveda and Integrative Medicine*, 2010, 1, 266–272.
 20. Tripathi KD, *Essentials of Medical Pharmacology*, 9th ed. New Delhi: Jaypee Brothers Medical Publishers, 2023, p. 857–859.
 21. Bennett JE, Dolin R, Blaser MJ, editors, Mandell, Douglas, and Bennett’s *Principles and Practice of Infectious Diseases*, 9th ed. Philadelphia, Elsevier, 2020, p. 3576–3578.
 22. Horton J. Albendazole: a review of anthelmintic efficacy and safety in humans, *Parasitology*, 2000, 121, S113–S132.
 23. Dayan AD. Albendazole, mebendazole and praziquantel, *Journal of Applied Toxicology*, 2003, 23(5), 277–284.

24. Githiori JB, Höglund J, Waller PJ, Baker RL. Anthelmintic activity of plant extracts against gastrointestinal nematodes of sheep, *International Journal of Parasitology*, 2004, 34(6), 759–767.
25. Eguale T, Tilahun G, Debella A, Feleke A, Makonnen E, In vitro and in vivo anthelmintic activity of crude extracts of *Coriandrum sativum* against *Haemonchus contortus*, *Journal of Ethnopharmacology*, 2007, 110(3), 428–433.

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