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Original Article

Bioactive Constituents of *Curcuma amada* Roxb. Rhizome and its Antimicrobial Activity against Food Spoilage Microorganisms

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ABSTRACT

Background: *Curcuma amada* Roxb. is popularly known as mango ginger due to its morphological similarity to ginger but has raw mango characteristics. It is well known for its several medicinal and pharmacological activities. **Objectives:** This study aimed to determine the antimicrobial activity of different extracts of *Curcuma amada* Roxb. rhizome and its phytochemical screening using Gas Chromatography-Mass Spectrometry (GC-MS) method. **Materials and Methods:** Antimicrobial activity of different *C. amada* rhizome extracts (acetone, hexane, ethanol and aqueous) were screened against spoilage bacteria and fungi using agar well diffusion method. The spoilage bacteria included *Klebsiella oxytoca, Enterobacter mori, Serratia marcescens, Bacillus subtilis* and *Bacillus inaquosorum*, while the spoilage fungi included *Penicillium citrinum, Alternaria alstroemeriae, Aspergillus welwitschiae, Aspergillus awamori* and *Aspergillus aflatoxiformans.* **Results:** *C. amada* rhizome ethanolic extract showed significant inhibitory activity against spoilage microorganisms at 10 mg/mL. MIC values for spoilage bacteria ranged from 0.5 to 5 mg/mL, whereas for spoilage fungi were 0.75 to 10 mg/mL. GC-MS analysis of ethanolic extract identified seven compounds *viz.* Linoleic acid ethyl ester, (E)-9-Octadecanoic acid ethyl ester, n-Hexadecanoic acid, Dotriacontane, 9,12-Octadecadienoic acid, 2,4-Di-tert-butylphenol and Octadecanoic acid, ethyl ester. **Conclusion:** The rhizome of *Curcuma amada* is a rich source of phytochemicals and has an antagonistic effect on food spoilage bacteria and fungi. The chemical constituents present in *C. amada* rhizome extract indicated antimicrobial potency against spoilage microorganisms that can be utilized in food preservation.

Keywords: Antimicrobial activity, *Curcuma amada*, Gas Chromatography-Mass Spectrometry, Rhizome extracts, Minimum Inhibitory Concentration.

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INTRODUCTION

Food-borne diseases and food security are major problems in developing countries, with more than 25% of fruits and vegetables spoiled during the post-harvest stages, particularly in transportation and storage. These are related to microbial contamination which can occur from soil, air or water at any developmental stage, during transportation or storage and involves phytopathogens, human pathogens and food spoilage microorganisms.[1] Some bacteria are capable of producing resistant structures like endospores or biofilms, enabling them to survive for longer periods in food.[2] While fungi produce toxins such as mycotoxins, contaminating foods and feeds and exposure to these can cause serious health risks for both humans and animals ranging from long-term chronic diseases like immune deficiency and cancer to acute poisoning leading to organ failure.[3] Traditionally, prevention of food spoilage and its causal agent is achieved with the use of chemical preservatives, but also concerns over their impact on human health. This has led to the increased interest in herbs, spices and plant extracts as natural, safer and effective alternatives for food preservation.[4]

Herbs and spices such as clove, cinnamon, turmeric, ginger, etc., have been used in traditional medicines and as flavoring agents for thousands of years. These are proclaimed as a treatment for many infectious diseases and ailments and thus also have gained importance in the pharmaceutical industry.[5] The extracts from medicinal herbs and spices consist of chemical compounds that impart several biological properties such as antimicrobial, antioxidant, anti-inflammatory, analgesic, cancer preventive, etc. These are considered a rich source of phytochemicals including flavonoids, phenolics, terpenes, saponins, glycosides and fatty

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acids compounds, usually synthesized as secondary metabolites required for plant survival and protection.[6]

Curcuma amada popularly known as mango ginger, is one such unique scientifically unexplored spice used for therapeutic purposes. It belongs to the family Zingiberaceae, is morphologically similar to ginger and has a raw mango flavor.[6] The genus *Curcuma* consists of more than 133 species and its origin was found in the Indo-Malayan region. *C. amada* is found wild in hilly areas of South India and North-eastern region of India. It is also cultivated in West Bengal, Karnataka, Tamil Nadu, Gujarat, Kerala, Uttar Pradesh and North-eastern states.[7]

Several chemical constituents have been isolated from *C. amada* rhizome and most of them are secondary metabolites possessing antioxidant and antimicrobial activities. Major components isolated and identified from its rhizome are difurocumenonol, amadaannulen, amadaldehyde, curcumin, myrcene, pinene, cis-ocimene, car-3-ene, etc.[6] The rhizome extracts of *C. amada* showed antibacterial activity against Gram-positive and Gram-negative bacteria.[8] It exhibited inhibitory activity against many pathogens including *Staphylococcus aureus, Micrococcus luteus, Enterobacter fecalis, Salmonella typhi* and *Bacillus cereus*.[9] Antifungal activity of *C. amada* rhizome was also determined against phytopathogens such as *Rhizoctonia solani, Sclerotium rolfsii, Colletotrichum falcatum, Fusarium solani*, etc. and human pathogens including *Candida* sp. and *Cryptococcus* sp. [10-12]

Despite its rich medicinal properties, the efficacy of rhizome extracts of *C. amada* in controlling food spoilage microorganisms is still an in-process investigation. This research highlights the antimicrobial attributes of *C. amada* rhizome against food spoilage and pathogenic microorganisms and also chemical constituents present in the rhizome which are responsible for its pharmacological properties.

MATERIALS AND METHODS

Rhizome collection

The fresh rhizomes of *C. amada* were procured from the local market in Bengaluru, Karnataka, India. The rhizomes were washed with running tap water to remove soil particles, then treated with 2% sodium hypochlorite solution and followed by washing with sterilized distilled water. The cleaned *C. amada* rhizomes were dried, homogenized and stored in air-tight bottles at 4°C.

Antimicrobial activity of rhizome extracts of *Curcuma amada*

Rhizome extracts preparation

A 10 g of homogenized rhizome paste was dissolved in 100 mL of hexane, acetone, ethanol and sterile distilled water to prepare different extracts. The contents were kept on a mechanical shaker for 72 hr at 25°C, filtered and the extracts were evaporated. These extracts were further resolubilized with 10% DMSO and stored in airtight bottles at 4°C for experiments.[13]

Test Microorganisms

Five bacterial and 5 fungal strains, obtained from various sources including spoiled fruits (apple, pomegranate, papaya and tomato) and oilseed (groundnut), were used to assess the efficacy of *C. amada* rhizome extracts. The bacterial strains included *Klebsiella oxytoca* (GenBank accession number ON413770), *Enterobacter mori*, (GenBank accession number ON413771), *Serratia marcescens* (GenBank accession number ON413914), *Bacillus subtilis* (GenBank accession number ON413772) and *Bacillus inaquosorum* (GenBank accession number ON413773), while the fungal cultures included *Penicillium citrinum* (GenBank accession number ON454381), *Alternaria alstroemeriae* (GenBank accession number ON470193), *Aspergillus welwitschiae* (GenBank accession number ON479653), *Aspergillus awamori* (GenBank accession number ON470195) and *Aspergillus aflatoxiformans* (GenBank accession number ON470194). These isolates are stored in the Department of Agricultural Microbiology, University of Agricultural Sciences, Bengaluru, maintained in slants and glycerol stocks.[14]

Inoculums preparation

The bacterial and fungal cultures were further inoculated in 100 mL nutrient broth and potato dextrose broth, respectively. The isolates were incubated on a rotatory shaker at 100 rpm for 24-48 hr at 30°C to get a density of 10^5 cells per mL.

Antimicrobial activity of rhizome extracts

The agar well diffusion method was carried out to study antimicrobial activity against all the test microorganisms.[15] DMSO served as control while acetic acid (5%) and sodium benzoate (5%) served as the standard reference for bacterial and fungal pathogens, respectively. Agar plates were prepared and seeded with broth containing microbial cultures. The 7 mm diameter agar wells were made using sterile cork borer and extracts (50 µL) were transferred into each well. The plates were allowed to stand for an hour for diffusion of extracts from wells and incubated at 28°C for 24-96 hr. The procedure was carried out under aseptic conditions. The presence of inhibition zones around the well was considered as an indication of antimicrobial activity which was measured using Vernier caliper.

Minimum Inhibitory Concentration (MIC)

Extract exhibiting the highest inhibitory activity at 10 mg/mL against all the bacterial and fungal strains was manipulated to determine the Minimum Inhibitory Concentration (MIC) using agar well diffusion method. Serial dilutions of the rhizome extract were prepared in the 10% DMSO, yielding different concentrations ranging from 0.1 mg/mL to 10 mg/mL. Agar plates were prepared and seeded with broth containing microbial

isolates. The 7 mm diameter agar wells were made using sterile cork borer and extracts (50 µL) were transferred into each well. The plates were allowed to stand for an hour for diffusion of extracts from wells and incubated at 28°C for 24 hr. The MIC was recorded as the lowest concentration that inhibited the growth of spoilage bacteria and fungi after 24 hr and 4 days of incubation, respectively. The inhibition zones around the wells were observed and recorded using Vernier caliper against the different concentrations of the effective rhizome extracts.[4]

Statistical analysis

The analyses were performed in triplicate and the values are expressed as mean±SEM.

Phytochemical Analysis

Preparation of rhizome extract

The extraction from washed, dried and homogenized *Curcuma amada* rhizome was carried out in ethanol by placing the mixture on a mechanical shaker for 72 hr at 110 rpm and filtered using Whatmann filter paper no. 1. The crude extract was further concentrated to dryness using a rotary evaporator at 45°C, re-dissolved in methanol and analyzed for the presence of bioactive compounds using GC-MS.[16]

Gas Chromatography-Mass Spectrometry (GC-MS) analysis

GC-MS analysis of the ethanol extract of *C. amada* rhizome was conducted at the Bioenergy and Quality Assurance laboratory, University of Agricultural Sciences, Bengaluru, using a Shimadzu QP2020 GC-MS model having Rtx- 5MS fused capillary column of dimensions 0.30 m× 0.25 µm× 0.25 mm D. Helium gas (99.99%) was used as a carrier gas at a constant flow rate of 1 mL/min, with an injection volume of 1 µL (split ratio of 1: 10). The injector temperature was maintained at 240°C, and the ion-source temperature was 220°C. The oven temperature was programmed from 110°C (isothermal for 2 min), with an increase of 10°C /min to 200°C, followed by an increase of 5°C/min to 280°C and ending with a 9 min isothermal at 280°C. The solvent delay was 0 to 3 min and the total GC/MS running time was 40 min. The relative percentage of each component was calculated by comparing its average peak area to the total areas.[16]

Identification of phytocomponents

The compounds in *C. amada* rhizome extracts were identified by comparing their mass spectra with data available in the National Institute Standard and Technology (NIST) library, Wiley GCMS library and previous literature. The spectra of the unknown compounds were compared with those of known chemical components. This allowed for the identification of components names, molecular weights and their structures in the *C. amada* rhizome extract.

RESULTS

Antimicrobial activity of rhizome extracts

Different extracts of *C. amada* rhizome were investigated to determine its antimicrobial activity against food spoilage and pathogenic microorganisms using agar well diffusion method. The evaluation of antibacterial and antifungal activity of all extracts is elucidated in Table 1 and Table 2. The results showed that ethanolic extract was potentially effective in retarding the growth of all spoilage bacteria and fungi at the concentration of 10 mg/mL, with the inhibition zone ranging from 15.3 to 26 mm. The inhibitory activity of hexane extract was observed only against Gram-positive bacteria (*Bacillus subtilis* and *B. inaquosorum*) and fungal strains including *Aspergillus awamori* and *Aspergillus aflatoxiformans*. While acetone and aqueous extract were not effective in controlling microbial growth.

The results indicated that all the spoilage bacteria were most susceptible to the rhizome extracts except *Serratia marcesens* (Table 1). Among fungal cultures, *Aspergillus aflatoxiformans*

Table 1: Antibacterial activity of all extracts of *Curcuma amada* rhizome against food spoilage bacteria representing zone of inhibition (in mm) and Minimum Inhibitory Concentration (MIC).

Extracts	*Klebsiella oxytoca*		*Enterobacter mori*		*Serratia marcesens*		*Bacillus subtilis*		*Bacillus inaquosorum*	
	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC
Hexane	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	20.0±0.0	-	18.0±0.1	-
Acetone	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	15.7±0.33	-	0.0±0.0	-
Ethanol	24.7±0.67	1.00	22.0±1.0	0.50	15.3±1.20	0.75	26.0±0.58	5.00	23.0±1.0	0.75
Aqueous	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	12.0±0.58	-	0.0±0.0	-
DMSO	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-
Acetic acid (5%)	46.3±0.88	-	38.0±1.73	-	52.7±1.45	-	42.7±1.45	-	48.0±0.58	-

Data are means of three replicates (n=3)±standard error.

and *Aspergillus welwitschiae* were found most resistant to the rhizome extract (Table 2). Hence, experiments were conducted to examine the Minimal Inhibitory Concentration (MIC) of the ethanolic extract of *C. amada* rhizome against these food spoilage microorganisms.

Minimum inhibitory concentration

The MIC of the most effective extract was determined using agar well diffusion method to assess bactericidal and fungicidal properties. The concentration effect of the ethanolic extracts of *Curcuma amada* rhizome is summarized in Table 1 and Table 2. MIC values for spoilage bacteria including *Klebsiella oxytoca, Enterobacter mori, Serratia marcescens, Bacillus subtilis* and *Bacillus inaquosorum* ranged from 0.5 to 5 mg/mL, whereas for spoilage fungi such as *Penicillium citrinum, Alternaria alstroemeriae, Aspergillus welwitschiae, Aspergillus awamori* and *Aspergillus aflatoxiformans*, were 0.75 to 10 mg/mL.

The results suggested that the spoilage bacteria were most susceptible to the ethanolic extract of *C. amada* rhizome when compared to spoilage fungi based on the MIC values. The rhizome extract was effective in controlling and preventing food spoilage microorganisms with lower MIC values.

Phytochemical screening

GC-MS chromatogram analysis of the ethanolic extract of *C. amada* rhizome (Figure 1) showed ten peaks which confirmed the presence of phytochemical constituents. On comparison of the mass spectrum of the constituents with the NIST library, the seven phytocompounds were characterized and identified (Table 3). The nature and bioactivity of chemical components identified in the rhizome were determined with the help of Dr. Duke's Phytochemical and ethnobotanical databases[17] and previous literature which is detailed in Table 4. The mass spectra of all the phytochemicals identified in the whole rhizome ethanolic extract of *C. amada* is presented in Figure 1. The most

Table 2: Antifungal activity of all extracts of *Curcuma amada* rhizome against food spoilage fungi representing zone of inhibition (in mm) and Minimum Inhibitory Concentration (MIC).

Extracts	*Penicillium citrinum*		*Alternaria alstroemeriae*		*Aspergillus welwitschiae*		*Aspergillus awamori*		*Aspergillus aflatoxiformans*	
	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC	Inhibition zone (mm)	MIC
Hexane	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	9.3±0.33	-	11.3±0.33	-
Acetone	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-
Ethanol	17.5±0.29	0.75	20.0±1.15	7.50	16.2±0.73	10.0	20.2±0.83	1.00	16.0±0.58	10.0
Aqueous	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-
DMSO	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-	0.0±0.0	-
Sodium benzoate (5%)	0.0±0.0	-	0.0±0.0	-	14.3±0.88	-	8.0±0.0	-	0.0±0.0	-

Data are means of three replicates (n=3)±standard error.

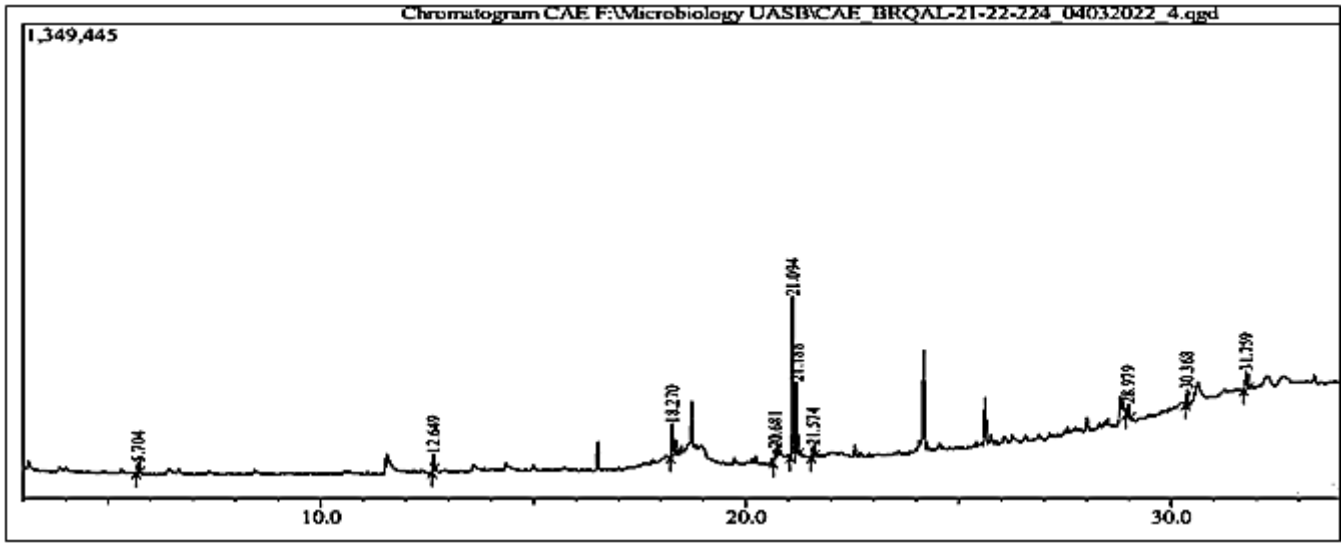

Figure 1: GC-MS chromatogram of ethanolic extract of *Curcuma amada* rhizome.

Table 3: Phytochemical compounds identified in the ethanolic extract of *Curcuma amada* rhizome by GC-MS.

Sl. No.	RT	Name of the compound	Mol. formula	MW	Peak area %
1.	5.704	Undecane	$C_{11}H_{24}$	156.31	2.45
2.	12.649	2,4-Di-tert-butylphenol	$C_{14}H_{22}0$	206.32	3.43
3.	18.270	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.42	10.89
4.	20.681	9,12-Octadecadienoic acid	$C_{18}H_{32}O_2$	280.45	4.28
5.	21.094	Linoleic acid ethyl ester	$C_{20}H_{36}O_2$	308.50	42.44
6.	21.188	9-Octadecanoic acid ethyl ester	$C_{20}H_{38}O_2$	310.518	18.61
7.	21.574	Octadecanoic acid, ethyl ester	$C_{20}H_{40}O_2$	312.53	2.82
8.	28.979	Dotriacontane	$C_{32}H_{66}$	450.86	3.35
9.	30.368	Dotriacontane	$C_{32}H_{66}$	450.86	4.80
10.	31.759	Dotriacontane	$C_{32}H_{66}$	450.86	6.93

RT-Retention Time, MW-Molecular weight of the compound.

Table 4: Bioactivity of phytocomponents identified in the ethanolic extracts of *C. amada* rhizome.

Sl. No.	RT	Name of compound	Nature	Biological Activity	References
1.	12.649	2,4-Di-tert-butylphenol	Phenolic	Antibacterial, Antifungal, Antioxidant activity, Anti-inflammatory, Antiviral, Insecticidal, Nematicidal, Cytotoxic	Zhao *et al.*, 2020.[21]
2.	18.27	n-Hexadecanoic acid	Fatty acid	Antioxidants, Anti-Inflammatory, Antimicrobial	Aparna *et al.*, 2012, Purushothaman *et al.*, 2024.[25,26]
3.	20.681	9,12-Octadecadienoic acid	Fatty acid	Antimicrobial, Antioxidant, Anti-inflammatory, Anti-carcinogenic	Kapoor *et al.*, 2014, Arora and Meena, 2017, Chirumamilla *et al.*, 2022.[28-30]
4.	21.094	Linoleic acid ethyl ester	Fatty acid ester	Antibacterial, Anti-inflammatory	Kusumah *et al.*, 2020, Kolar *et al.*, 2019.[34,35]
5.	21.188	(E)-9-Octadecanoic acid ethyl ester	Fatty acid ester	Antibacterial	Akin-Osanaiye *et al.*, 2011.[27]
6.	21.574	Octadecanoic acid, ethyl ester	Fatty acid ester	No activity reported	-
7.	28.979	Dotriacontane	Alkane	Antimicrobial, Antioxidant, Anti-Inflammatory, Immunomodulatory	Dons and soosairaj, 2016, Addai *et al.*, 2022, Gomes *et al.*, 2020.[22-24]

*Source-Dr. Duke's Phytochemical and ethnobotanical databases. RT-Retention time.

prevailing compounds among the seven compounds identified were Linoleic acid ethyl ester (42.44%), (E)-9-Octadecanoic acid ethyl ester (18.61%) and n-Hexadecanoic acid (18.27%) followed by Dotriacontane (6.93%), 9,12-Octadecadienoic acid (4.28%), 2,4-Di-tert-butylphenol (3.43%) and Octadecanoic acid, ethyl ester (2.82%).

DISCUSSION

Curcuma amada rhizome extracts were effective against the food spoilage microorganisms, but the antimicrobial activity varied according to the solvent. The ethanolic extract showed broad inhibitory effects against all tested bacteria and fungi. The MIC values confirmed that spoilage bacteria were more susceptible to rhizome extracts than spoilage fungi. The microorganisms included in the present study were isolated from spoiled fruits and oilseed and are considered the most common source of food-borne diseases. These are also known for producing toxins and other metabolites affecting human health.[14] The results are consistent with the previous studies relating the antimicrobial activity of *C. amada* rhizome against phytopathogens, human pathogens, clinically isolated fungal cultures, dermatophytes and yeasts to the presence of specific components in it.[9-11,18,19]

GC-MS analysis revealed the presence of various phytochemicals like fatty acids, fatty acid esters, phenols and alkane compounds in ethanolic extract of *C. amada* rhizome. The results are similar to the previous literature confirming the presence of phenolics, fatty acids and its derivatives, etc.[6,20] However, the chemical constituents identified in this study differed from previous literature. 2,4-Di-tert-butylphenol, a phenol compound and Dotriacontane, an alkane compound, both are identified in various plant sources and known for their biological properties. Major compounds characterized in the ethanolic extract contained fatty acids and their derivatives. Among the components identified, only hexadecanoic acid has been previously reported in *C. amada* rhizome.

2,4-Di-tert-butylphenol, already reported in various plants and microorganisms, is a potent antimicrobial agent. It is found effective against Gram-positive bacteria such as *Bacillus* spp., *Streptococcus* spp., as well as fungi causing root rot including *Fusarium* spp., *Phytophthora* spp. and *Verticillium* spp. It also exhibits antiviral, antioxidant, anti-inflammatory, nematicidal, insecticidal and cytotoxic properties.[21] Dotriacontane, an alkane compound, has been identified in several plants such as *Tynanthus micranthus, Justicia transquebariensis, Opuntiaficus indica*, etc., possesses a range of biological properties including antimicrobial, anti-inflammatory and antioxidant activity.[22-24] n-Hexadecanoic acid, isolated and identified from the medicinal plant *Excoecaria agallocha*, showed antimicrobial activity against *Aeromonas hydrophila, Vibrio harveyi, Bacillus subtilis, Escherichia coli* and *Klebsiella pneumonia*. Also, it has antioxidants and anti-inflammatory activities.[25,26] Similarly, 9-Octadecanoic acid ethyl ester, also known as ethyl oleate, was isolated and identified in essential oil of medicinal plant *Phyllanthus amarus*. It showed inhibitory activity against pathogens such as *Pseudomonas aeruginosa, Proteus vulgaris, Escherichia coli, Streptococcus pneumonia, Klebsiella pneumonia, Staphylococcus aureus* and *Micrococcus luteus*.[27] 9,12-Octadecanoic acid has been reported in medicinal plant *Solanum khasianum* and has antimicrobial, anti-carcinogenic, antioxidant and anti-inflammatory properties.[28-30]

The possible mechanisms for the antimicrobial activity may include phytochemical structures causing membrane disruption, interfering with cell permeability, inhibiting cell wall or protein synthesis and modifications in structural composition.[6,11,12] Various studies revealed that 2,4-di-tert-butylphenol disrupts biofilms and enhances antimicrobial diffusion in bacteria such as *Serratia marcesens*, leading to the eradication of biofilms.[31] It inhibits spore germination and hyphal growth in fungi and disrupts biofilms in *Candida albicans* by inhibiting hyphal development.[32,33] The presence of these compounds in *C. amada* and their medicinal properties, as well as their effects on food spoilage microorganisms is yet to be explored.

CONCLUSION

The rhizome of *Curcuma amada* is a rich source of phytochemicals and has an antagonistic effect on food spoilage bacteria and fungi. The compounds identified include 2,4-di-tert-butylphenol, dotriacontane, hexadecanoic acid, 9,12-octadecadienoic acid, 9-octadecanoic acid ethyl ester and linoleic acid ethyl ester that may contribute to its antimicrobial activity. These compounds are natural antimicrobials and antioxidants and are acceptable in terms of their origin. This study demonstrated the efficacy of *C. amada* rhizome against food spoilage microorganisms, suggesting that these phytochemicals can be further purified and studied against food pathogens. The *C. amada* rhizome can be utilized for biopreservation of foods and plant protection against pathogens.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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ABBREVIATIONS

GC-MS: Gas chromatography-mass spectrometry, **MIC:** Minimum inhibitory concentration, **RT:** Retention time, **MW:** Molecular weight, **DMSO:** Dimethyl sulfoxide.

AUTHORS' CONTRIBUTION

All authors have read and approved the final manuscript.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

This study did not involve human participants or animals. Therefore, ethical approval was not required.

SUMMARY

Herbs and spices have been used in traditional medicines and as flavor enhancers for thousands of years. These are proclaimed as a treatment for many infectious diseases and ailments and thus also have gained significance in the pharmaceutical industry. *Curcuma amada* popularly known as mango ginger, belongs to the family Zingiberaceae. Despite its rich medicinal properties, the effectiveness of rhizome extracts of *C. amada*

in controlling food spoilage microorganisms is still under investigation. This research evaluated the antimicrobial activity of *C. amada* rhizome and identified its chemical constituents which are responsible for its pharmacological properties. This study showed that rhizome extracts exhibited efficacy against food spoilage microorganisms and GC-MS analysis confirmed the presence of bioactive constituents. Thus, the phytochemicals can be further purified from *C. amada* rhizome and studied for their antimicrobial activity against food pathogens. It can also be utilized for biopreservation of foods to prevent post-harvest losses and protect crops against phytopathogens.

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