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## PHYTOCHEMICAL ANALYSIS AND ANTIBACTERIAL EVALUATION OF *CURCUMA LONGA* AND *CURCUMA AROMATICA* AGAINST ENTERIC POULTRY PATHOGENS

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**ABSTRACT:** After an increasing concern of sub-therapeutic use of antibiotics in poultry to treat enteric and other infections, an interest in alternative and efficient products with antibacterial properties has increased. From ancient time, the plants are constantly contributing as a useful source for the therapeutic and pharmaceutically important compounds. In this study, we therefore tested for the presence of important phytochemicals and antibacterial potential of *Curcuma longa* and *Curcuma aromatica* rhizome extracts against poultry enteric pathogens. Pharmaceutically important phytochemicals including alkaloids, flavonoids, terpenoids, steroids, saponins, phenols, glucosides, etc. were found to be present in extracts of *C. longa* and *C. aromatica*. The extracts of *C. aromatica* exhibited excellent inhibitory action against *Escherichia coli* and *Salmonella enteritidis*. However, *C. longa* extracts showed zone of inhibition against *E. coli* alone. This study provides significant insight into therapeutic application of *Curcuma spp.* against enteric poultry pathogens, suggesting it's potential as an alternative to antibiotics and opens the way for further use in poultry feed for effective production.

**INTRODUCTION:** Indian poultry industry is one of the fastest growing segment in agriculture sector, provides source of livelihood to 4 million people directly or indirectly <sup>1</sup>. Due to relatively lower price, excellent nutritional profile and religious acceptability; poultry meat and egg consumption is gaining more popularity among developing nations<sup>2</sup>.

As a result, the poultry production in India is doubled in last two decades. In spite of substantial advancements in poultry sector, the industry still faces numerous challenges including bacterial and viral diseases.

Currently, enteric diseases in poultry are root cause of lower productivity, increased mortality and possibility of zoonoses <sup>3</sup>. Generally these infections are treated by using antibiotics but increasing concern of antibiotics residues and ban on sub-therapeutic antibiotics use in many developed countries generating interest for the development of an alternative method to control poultry associated pathogens in different parts of the world <sup>4</sup>. From ancient time, plants and its products are used as a

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medicine to treat various diseases in human and animals <sup>5</sup>. Many plants secrete thousands of phytochemicals showing inhibitory effects against different types of micro-organisms <sup>6</sup>. However, the potential of many plants as a source of new drugs is still largely unexplored. *Curcuma longa* and *Curcuma aromatica* are perennial rhizomatous shrubs belongs to the Zingiberaceae family <sup>7</sup>. Both the species are native to the Indian subcontinent and South East Asia <sup>8</sup>. They are traditionally used as a home remedy for various diseases in India. *In-vitro* antimicrobial and anti-inflammatory activity of *Curcuma spp.* is reported previously <sup>9,10</sup>. In this research work, we have explored antibacterial activity of *Curcuma longa* and *Curcuma aromatica* extract against enteric avian pathogens including *Escherichia coli* and *Salmonella enteritidis*.

## MATERIALS AND METHODS:

**Collection of Plant Materials:** Dried rhizomes of *Curcuma longa* and *Curcuma aromatica* were collected from local Ayurvedic Medicinal Shop, Latur. The plant material was properly identified with the help of authentic literature and documented with their characteristics features. The rhizomes were further powdered and stored at room temperature till further use.

**Preparation of Plant Extract:** The preparation of extract was done by using continuous hot extraction method. 10 gm of rhizome powder was packed in Soxhlet apparatus and extracted with 150 ml water and methanol subsequently. The liquid extracts were collected in conical flasks and remaining solvent is removed by distillation <sup>11</sup>. The prepared extracts were further used for preliminary phytochemical analysis and its antibacterial potential against poultry pathogens.

**Preliminary Phytochemical Analysis:** Preliminary phytochemical screening of water and methanolic extract of rhizome of *Curcuma longa* and *Curcuma aromatica* was carried by using standard procedures <sup>12</sup>. The tests were performed to check the presence of important phyto-constituents like; alkaloid, flavonoid, phenols, saponin, terpenoid, steroid, carbohydrate, protein, glucosides.

**Determination of Antibacterial Activity:** The bacterial cultures of enteric pathogens *i.e.* *E. coli* and *S. enteritidis* isolated from infected chickens were provided by Oyster Biologicals Pvt. Ltd., Omerga (Maharashtra), India. The antibacterial activity of rhizome extracts against *E. coli* and *S. enteritidis* was tested by using Kirby-Bauer method with few modifications <sup>8</sup>.

In brief, overnight grown cultures of *E. coli* and *S. enteritidis* were inoculated on Mueller Hinton Agar (HiMedia, India) plates by using sterile swabs in order to get uniform and thick growth after incubation. Wells of 6 mm diameter were formed on inoculated Mueller Hinton Agar by using appropriate sized cork borer. The dried rhizome extracts of *Curcuma longa* and *C. aromatica* were dissolved in dimethylsulfoxide (DMSO) (SRL, India) at the concentration of 50 mg/ml. 75 µl of DMSO dissolved extracts were then filled in wells prepared on MHA plates. Inoculated plates were further kept for incubation at 37 °C for 18-24 h.

## RESULTS AND DISCUSSION:

**Phytochemical Analysis:** Phytochemical analysis was carried out to detect the presence of any pharmaceutically active compound in rhizomes of *Curcuma longa* and *Curcuma aromatica*.

**TABLE 1: QUALITATIVE ANALYSIS OF THE PHYTOCHEMICALS OF C. LONGA AND C. AROMATICA**

Phytochemicals	Test	<i>C. longa</i>		<i>C. aromatica</i>	
		Water	Methanol	Water	Methanol
Alkaloid	Mayer's Test	+	+	+	+
Flavonoids	Shinoda Test	+	+	+	-
Phenols	FeCl <sub>3</sub> Test	+	+	+	+
Terpenoids	Liebermann Burchards Test	-	-	+	+
Steroids	Salkowski Test	+	+	+	+
Carbohydrates	Fehling's Test	+	+	+	+
Proteins	Biuret Test	+	+	+	+
Saponins	Foam Test	+	+	+	-
Glucosides	Legal's Test	+	+	-	-

+ Indicates the presence of constituent, - Indicates the absence of constituents

Major phytochemicals like alkaloids, flavonoids, phenols, saponins, steroids, etc. were found in both *Curcuma longa* and *Curcuma aromatica* extracts **Table 1**. Similar findings were also noted by various authors<sup>10, 11, 13</sup>. Glucosides were found to be present in *Curcuma longa* but absent in *Curcuma aromatica* extracts. On the other hand, terpenoid was found in *Curcuma aromatica* but lacking in *Curcuma longa*. The absence of glucosides is also confirmed in *C. aromatica*<sup>14</sup>. Presence of alkaloids, flavonoids and phenolics strongly suggest plants involvement in antibacterial activity<sup>15</sup>. In our experiments, all of these phytochemicals were noted in *Curcuma longa* and *Curcuma aromatica*.

**Antibacterial Activity:** Antibacterial activity of methanolic and Water extracts of *C. longa* and *C. aromatica* was tested against poultry enteric pathogens *E. coli* and *S. enteritidis* recovered from chicken gut. Both methanolic and water extracts (50 mg/ml) of *Curcuma longa* showed moderate zones of inhibition against *E. coli* but no antibacterial potential was observed against *S. enteritidis*. However, methanolic extract of *C. aromatica* found to be effective and exhibited good zone of inhibition against *E. coli* ( $14.66 \pm 1.15$

mm) and *S. enteritidis* ( $13.00 \pm 1.00$ mm). Similarly, water extract of *C. aromatica* also generated sensible effect against *E. coli* ( $11.66 \pm 0.57$  mm) and *S. enteritidis* ( $9.00 \pm 1.00$  mm) **Table 2**. Various species of *Curcuma* have already exhibited antimicrobial properties against human and avian pathogens in recent years<sup>16, 17, 18</sup>. A report also suggested the antibacterial potential of *Curcuma aromatica* against human pathogenic *E. coli*, *S. typhi*, *P. aeruginosa* and *P. vulgaris*<sup>10</sup>. A recently published report confirmed antibacterial effect of curcuma against *S. enteritidis* infection in chicken<sup>19</sup>.



**FIG. 1: ANTIMICROBIAL ACTIVITY OF CURCUMA AROMATICA AGAINST S. ENTERTIDIS**

**TABLE 2: ANTIBACTERIAL ACTIVITY OF C. LONGA AND C. AROMATICA EXTRACTS**

Test pathogen	Mean Zone of Inhibition (mm) $\pm$ SD			
	<i>Curcuma longa</i>		<i>Curcuma aromatica</i>	
	Methanolic	Water	Methanolic	Water
<i>E. coli</i>	$9.33 \pm 0.57$	$10.66 \pm 1.50$	$14.66 \pm 1.15$	$11.66 \pm 0.57$
<i>S. enteritidis</i>	-	-	$13.00 \pm 1.00$	$9.00 \pm 1.00$

**CONCLUSION:** Medicinal plants are always considered as an effective source of traditional and modern medicines. Many literatures suggest the medicinal and cosmetic importance of turmeric. In our study photochemical analysis reveals the presence of important phytochemicals like alkaloid, flavonoids, phenols, steroids, saponins etc. in both *C. longa* and *C. aromatica*. Extracts of *C. aromatica* rhizomes exhibited potential inhibitory effect against enteric pathogens of poultry. Hence, this study concludes that, the *Curcuma aromatica* rhizomes with certain processing can be used as a potential alternative for traditional treatments like antibiotics in enteric infections of poultry.

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**CONFLICT OF INTEREST:** The authors declare that they have no competing interests.

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