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Therapeutic Applications of Antimicrobial Effectiveness of Curcuma amada

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ABSTRACT
This study was used SPSS software and done by Mann-Whitney U test to compare the antimicrobial efficacy of Curcuma amada extract with chlorhexidine gluconate mouthwash. It was shown that Curcuma amada had higher antimicrobial activity at all the concentrations used in the study; 5%, 10%, and 25%. The median zones of inhibition for Curcuma amada were significantly larger than those for chlorhexidine gluconate: To smoothen this process, several changes need to be made, they are as follows: 9 mm versus 1. 5 mm at 5%, 8. 6 mm versus 3. 5 mm at 5% and 20 respectively, 6 mm at 10% and 11 at 15%. 9 mm versus 5. 8 mm at 25%. Mann-Whitney U test statistics were 0 being equal to the Z-values for all the concentrations, they ranged from -6. 72 at 5% and 25%, and -6. It was indicated that at 10%, 71 made the list and all had P-values below 0. 001, which cast the findings at a highly significant level of difference. The current research presents the strong antimicrobial activity of Curcuma amada extract that enhances with concentration and characterized by a greater value than the chlorhexidine gluconate. The studies indicate that Curcuma amada may alternatively or in conjunction with the conventional mouthwash agents. Further studies should be directed to extract definition of the bioactive compounds of Curcuma amada and to perform the in vivo experiments to support these results and to consider further use of Curcuma amada in the therapy of certain diseases.

Keywords: Curcuma amada, Antimicrobial activity, Medicinal uses, Plant derived compounds, The composition of the plant.

I. INTRODUCTION

Curcuma amada more familiarly referred as mango ginger has long been recognized for its prospective medicinal uses especially for it share of antimicrobial activity. This is part of the Zingiberaceae family, and this rhizome has been used in cultures apart from a spice for food but also a cure for many illnesses. Modern scientific studies have therefore aimed at establishing through methodological research the extent that such traditional practices have puffed in empirical evidence for the claims of antimicrobial properties of AC. This introduction will offer an important background in relation to Curcuma amada and is particularly concerned with its significance within antimicrobial therapy and what we might be able to learn from it therapeutically. Curcuma amada has been reported to contain phytochemicals that enable it to posses good antimicrobial activities. It is rich in a number of bioactive compounds such as curcuminoids, essential oils and flavonoids which have been proposed as the main active components responsible for the pharmacological activities of the plant. The active principles – curcuminoids – are well known for their antioxidant and anti-inflammatory properties; these two properties are thought to improve the antimicrobial effect of these compounds. Whereas essential oils bear a wide range of antimicrobial activity because of their multiple components which all together enhance the filed's antimicrobial efficacy. The second main class of compounds is flavonoids which are implicated in the modulation of cell signalling and have been also considered as being capable to interact with microbial cell envelopes, thereby enhancing the performance of the plant.

Cultural activities in respect of Curcuma amada are too well authenticated as they are involved in the treatment of ailments relating to the cur, respiratory complaints and skin diseases. The following are the traditional uses that form grounds for scientific research in regard to its antibacterial nature. Contemporary science has attempted to substantiate these traditional remedies by using scientific methods to extract and identify, the active antibacterial compounds contained within the plant. There are well-documentations revealing that extracts of Curcuma amada possess strong antimicrobial efficacy for almost all types of

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pathogenic microorganisms out of bacteria, fungi, viruses and others. Also, the plant has significant activity against both Gram-positive and Gram-negative organisms, including Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. This is so especially when adopting the perspective of increasing antibiotic-resistant bacterial strains as a major challenge to conventional antimicrobial strategies.

Moreover, antifungal effect has been observed to be very high in Curcuma amada in addendum to its antibacterial effect. Clinical studies reveal that its extracts can act as fungicides; it arrests the growth of fungi such as Candida species, which are likely to trigger opportunistic infections. The potential offered by Curcuma amada is based on an inhibition of the enzyme required for fungal cell membrane synthesis and other pathways in the fungal cell which makes Curcuma amada also a potential natural source for a broad spectrum antifungal drug. There have also been attempts to understand Curcuma amada's antiviral properties, including the findings that it has extracts that might have inhibitory effects on specific viruses. While still unclear, the therapeutic value of Curcuma amada regarding antiviral effect is proposed to operate through bew stimulus replacing the viral one or virucidal activity. This potential antiviral activity has lead to the increase interest in Curcuma amada as a source of novel antiviral agents. It can be argued that the results in question are due to the bioactive compounds whose list is rather numerous for Curcuma amada. Curcuminoids containing curcumin, have numerous antimicrobial properties due to their action on microbial cell membranes and on microbial proteins and enzymes. Essential oils and flavonoids also play part in the plants antimicrobial property and its ability to penetrate microbial cell walls and operate through the immune system from the host organism. Thus, these compounds together contribute the wide accomplishment of the antimicrobial function and so the Curcuma amada may be considered for further study as a new drug for the remedy of diseases.

Nevertheless there are some limitations that still obscure the full exploitation of Curcuma amada as an antimicrobial agent. Some of the other questions that need to be answered include the pharmacokinetics particularly the bioavailability of its active compounds as well as the dosage and form that should be used in treating diseases. Thirdly, extensive clinical researches should be conducted to determine the side effects and efficacy of in different treatment settings. Furture studies employing both the indigenous wisdom and the scientific methods will go a long way in triggering the full anti-inflammatory and other pharmacological efficacy of Curcuma amada besides extending its use today's medicine.

II. METHODOLOGY

Details of steps used in the present in vitro study to determine the antimicrobial activity of Curcuma amada extract with varied concentration with reference to chlorhexidine gluconate against Streptococcus mutans are provided in this section. The objective of the study was to evaluate the antibiotic activity of C. amada which was done by determining the zones of inhibition by different concentrations of extract and CG however the primary objective was to find the minimum inhibitory concentration of C. amada.

2.1 Study Design

This in vitro experimental work was done after receiving the institutional ethics clearance. The present work aimed to evaluate the antimicrobial potential of the C. amada extract and chlorhexidine gluconate against the microorganism S. mutans. Five percent, 10% and 25% concentrations of C. amada and c[h]g solutions were prepared.

2.2 Preparation of Curcuma amada Extract

Raw Material

Raw C. amada was purchased and grounded and sieved to obtain the seeds.

Extraction Process

1. **Drying and Blending**
   - 200 grams of C. amada rhizomes were dried for 15 days.
   - The dried material was ground into a fine powder.

2. **Ethanol Extraction**
   - The powdered material was partitioned into three bits (5 grams, 10 grams, and 25 grams) and set into independent sterile containers.
   - Each segment was blended in with 100 ml of ethanol.
   - The blends were permitted to douse for 48 hours.

3. **Centrifugation and Filtration**
   - The drenched arrangements were centrifuged at 2000 rpm for 10 minutes.
   - The supernatant was separated utilizing a 0.45 µm film channel.

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4. **Concentration and Storage**
- Extracts were ready at centralizations of 5%, 10%, and 25%.
- The removes were put away at 20°C until additional utilization.

2.3 Preparation of S. mutans Culture

1. **Nutrient Broth and Agar Preparation**
- S. mutans strains (ATCC 25175, HIMEDIA) were refined in supplement stock.
- The societies were hatched at 37°C for 24 hours.
- Post-hatching, the strains were streaked onto supplement agar plates to guarantee legitimate development.

2.4 Preparation of Chlorhexidine Gluconate Extract

1. **Dilution Process**
- 0.2% chlorhexidine gluconate mouthwash was estimated in measures of 5 ml, 10 ml, and 25 ml.
- Each sum was moved to marked recepticles and weakened with 95 ml, 90 ml, and 75 ml of refined water, individually.
- The arrangements were blended completely.

2.5 Antimicrobial Testing: Ditch Plate Method

1. **Agar Plate Preparation**
- Solid agar plates (60 in total) were prepared with wells punched out using a 7 mm diameter punch.
2. **Filling the Wells**
- The wells were filled with the prepared extracts of C. amada and chlorhexidine gluconate at various concentrations.
- Separate plates were used for each concentration of C. amada and chlorhexidine gluconate.
3. **Incubation and Measurement**
- The plates were incubated at 37°C for 48 hours.
- After incubation, the zones of inhibition were measured in millimeters using Vernier calipers.

Error Minimization

- All procedures were carried out in triplicate to ensure accuracy and reliability of the results.

This approach offers a systematic approach for analysing the efficacy of Curcuma amada extract with refrence to chlorhexidine gluconate as an antimicrobial agent. The preparation of extracts, culture media to which the extracts were added and the application of the ditch plate method were all devised in a bid to show the possible therapeutical effect of C. amada as an anti-microbial.

III. RESULT & DISCUSSION

The antimicrobial efficiency of Concentration of Curcuma amada extract and Chlorhexidine gluconate mouth wash were compared statistically using statistical Package for Social Science (SPSS) ver 19. The normality of the data was also not tested for normality hence nonparametric tests were used. In the result analysis assessing the minimum zones of inhibition of the two substances at 5%, 10% and 25% concentrations the Mann-Whitney U test was applied to determine the median values. In the present study, a significance level of $P < 0$ was used. To assess the comparisons 05 was considered for all the comparisons.

Measurement of Zone of Inhibition

The zones of inhibition were determined in millimeter upon inoculation of agar plates with the extracts. These findings suggested that there was significantly higher antimicrobial activity of Curcuma amada extract than chlorhexidine gluconate mouthwash.

Curcuma amada Extract vs. Chlorhexidine Gluconate Mouthwash

- **5% Concentration:**
  - Curcuma amada Extract: The median of the various tests was 4 in the zone of inhibition. 90 mm (Range: 4. Graded as 40 to 5. 00 mm).
  - Chlorhexidine Gluconate Mouthwash: the median zone of inhibition was 1. 90 mm (Range: 1. between 40 and 2. 00 mm).
- **10% Concentration:**
  - Curcuma amada Extract: The median zone of inhibition was 8 for all the bacterial isolates. 60 mm (Range: 8. 20-8. 70mm).
  - Chlorhexidine Gluconate Mouthwash: Median zone of inhibition was 3. 60 mm (Range: III 30-3. 90 mm).
- **25% Concentration:**
  - Curcuma amada Extract: The median of the zone of inhibition was 11 units. 90 mm (Range: 11. 50 to 12. 00 mm).
  - Chlorhexidine Gluconate Mouthwash: The mean of the values of inhibition diameters was 5 mm; the median was the same. 80 mm (Range: 5. 60 to 6. 10 mm).

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In the present study, the significant P value for comparing two subsisting was considered by employing the Mann-Whitney U test. The comparison of the means of all groups and the control group gave P values of less than 0. This implies that the efficacy of antimicrobials in the presence of different biofilms was significantly alternated hence receiving the 001 value which shows a highly significant difference.

Concentration-Dependent Effect

This piece of work also shows that the extent of antimicrobial activity increases with concentration in a way that is dependent on the substances being tested. As the concentration of the extract was gradually increasing from 5% to 25%, the zone of inhibition increased as well, and Curcuma amada extract was found to be more effective than chlorhexidine gluconate.

- At 5%, the zone of inhibition for Curcuma amada was up to a median of the zone for chlorhexidine gluconate with 2. 67 times the size.
- At this concentration, the median zone of inhibition of Curcuma amada extract was more than double that of chlorhexidine gluconate.
- When applied at a concentration of 25%, Curcuma amada had a significantly greater median zone of inhibition than chlorhexidine gluconate.

The median zones of inhibition in the antimicrobial efficacy of Curcuma amada and chlorhexidine gluconate that were employed in this study was observed to be higher in Curcuma amada than in chlorhexidine in all the concentrations administered. At 5% concentration, the CUR was found to be 4 for Curcuma amada herbs in the median zone of inhibition. 9 mm (interquartile range [IQR]: They are a universal form of communication and together with gesture we have the following four types: 8 to 4. 9 mm), but no less than 4. 4 mm with a maximum of 5. 0 mm whilst chlorhexidine gluconate revealed a median zone of inhibition of 1. 9 mm (IQR: 1, from 8/10 of a millimeter to 2. 0 mm, at the very least one. There was 4 mm of movement in any direction with a maximum of 2. 0 mm This was further reduced at the 10% concentration with Curcuma amada having a median zone of inhibition of 8. 6 mm (IQR: 8 , actual 8. 5 to 8. 7 mm) while the median of the zone of chlorhexidine was 3. 6 mm (IQR: 3. 5 to 3. 8 mm). At its highest concentration of 25%, Curcuma amada had a minimum zone of inhibition of 11mm. 9 mm (IQR: 11. 8-12. 0 mm) wider than chlorhexidine gluconate with a median villus length of 5. 8 mm (IQR: European American men had a slightly greater average range in their preferred width – 5. 7 to 5. 9 mm. The fact that the median values for Curcuma amada are also consistently higher at all the concentration levels established the fact that Curcuma amada has much greater antimicrobial activity than chlorhexidine gluconate. The ranges and interquartile ranges also stress the differences in the results of Curcuma amada, which reveals a high efficacy of the antimicrobial action that is statistically significant at all the studied concentrations.

Table 1 Descriptive Statistics of Minimum Zone of Inhibition Across Groups

Concentration	Group	Q1	Median	Q3	Minimum	Maximum
5%	Curcuma amada (n=30)	4.8	4.9	4.9	4.4	5
	Chlorhexidine (n=30)	1.8	1.9	2	1.4	2
10%	Curcuma amada (n=30)	8.5	8.6	8.7	8.2	8.7
	Chlorhexidine (n=30)	3.5	3.6	3.8	3.3	3.9
25%	Curcuma amada (n=30)	11.8	11.9	12	11.5	12
	Chlorhexidine (n=30)	5.7	5.8	5.9	5.6	6.1

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The c comparisons conducted through the Mann–Whitney U test for minimum inhibitory zones of Curcuma amada and chlorhexidine gluconate at various concentrations were statistically highly significant. In all the concentration we prepared and assayed; 5%, 10% and 25% the Mann Whitney U statistic was 0 meaning that the two substance's inhibition zone are completely different. The corresponding Z-values were -6. 72, while the control value was -6 at 5% and 25% concentrations of the reagent respectively. 71 at 10%, for the inhibition effects, and there are marked differences. The significance level of all the comparisons was set at using P-values below 0. It is worth mentioning that it is slightly less than 0, scientific value of 001, which is well below the conventional threshold of 0. 05 for statistical significance. The overall extremely low value of P value, obtaining in the entire procedure of the research, indicates the fact that antimicrobial activities of Curcuma amada are statistically significantly higher in comparison to chlorhexidine gluconate, with every concentration level of curcuma amada being higher than the concentration of the chlorhexidine gluconate understood in the study.

Table 2 Comparison of Minimum Zone of Inhibition at Different Concentrations

Statistic	**5%**	**10%**	**25%**
Mann-Whitney U	0	0	0
Z	-6.72	-6.71	-6.72
P	<0.001	<0.001	<0.001

The findings of this research confirm that Curcuma amada extract possess higher antimicrobial index against S. mutans than chlorhexidine gluconate descending with ascending concentration. Further studies should involve identification of the compounds responsible for these effects and in vivo assistence of the results and possible realization of the effects in an actual clinical environment.

IV. CONCLUSION

The antimicrobial efficacy of Curcuma amada extract when compared to that of chlorhexidine gluconate mouthwash using the SPSS software and non-parametric Mann Whitney U test was found out to be significant at $p < 0.05$ and Curcuma amada was found to be significantly superior to chlorhexidine gluconate at 5, 10 and 25% concentrations. The median zones of inhibition for Curcuma amada were significantly larger compared to chlorhexidine at each concentration level: Four. 9 mm vs. 1. 055 at 5%, 8. 6 mm vs. 3. 6 mm at 10%, and 11. 9 mm vs. 5. 8 mm at 25%. The Mann-Whitney U test gave the following results; the U statistic was 0 for all the concentrations, and the Z-values were -6. 61 at 5% and 25%, and -6. 71 at 10%, and all for P-values less than 0. 001, proving significant differences in the studied parameters between the intoxicated and non-intoxicated groups. This gives a significant antimicrobial effect of Curcuma amada showing an increase in the concentration series, beyond that of chlorhexidine gluconate. The present work indicate that Curcuma amada possess enhanced antimicrobial efficacy over S. mutans as compared to conventional antimicrobial agents used in mouthwashes. Subsequent studies should include extraction of biomolecules in Curcuma amada and further in vivo investigations with systematic endeavours to prove these facts practically and apply in clinic.

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