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Pharmacological Insights into the Medicinal Potential of Curcuma longa

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ABSTRACT
This research assesses the yield and bioactive properties of Curcuma longa rhizomes with diverse solvents. Extractive yield values indicate significant variability: The highest yield was recorded in ethanol (1104 mg, 11. 04%) followed by hydro –alcoholic (348 mg, 3. 48%) and chloroform extract yield (249 mg, 2. 49%). All the solvents used in the study yielded ethanol to be the best solvent in extracting of bioactive compound from the turmeric rhizomes while chloroform recorded lower result. When screening with phytochemical analysis, the chloroform extracts show no presence of phytochemical analysis while the ethanol and hydro-alcoholic extracts show the presence of all the six phytochemicals tested, thus pointing to the method having the ability to extract almost all phytochemicals. Molecular determinations of cytotoxicity also show that ethanol extracts have the highest level of anticancer activity, with the lowest IC 50 for prostate and oral carcinoma cells as compared to the hydro-alcoholic and chloroform extracts. Also, the percentage yield of curcuminoids extracted with acetone is around 16 % from different batches of raw material which shows that acetone extraction is consistent and suitable where a large amount of material is to be extracted. Thereby re-emphasizing the therapeutic uses of Curcuma longa is bio activity of ethanol over other solvents and selective solvation of curcuminoid from the mixture by acetone.

Keywords: Curcuma longa, Phytochemical extraction, Ethanol solvent, Cytotoxicity activity, Yield of curcuminoid.

I. INTRODUCTION

Curcuma longa more ordinarily referred to as turmeric has regularly earned its place in folk and other systems of medication including Ayurvedic and TCM. The pharmacological significance of the plant is mainly due to the presence of beautiful number of bio- active compounds of which the most important is Cur cumin, a polyphenolic flavonoid pigment which imparts the yellow color to the turmeric rhizomes. In a recent research the present anathema of Curcuma longa has been identified and moreover, the potential therapeutic role for several diseases has been explained. It has an active constituent that is curcumin, which possesses qualities of an efficient anti-inflammatory and antioxidant component. Due to its ability to down regulate multiple inflammatory procedures and neutralization of free radicals curcumin has utility in chronic inflammatory diseases like arthritis, inflammatory bowel disease etc. This in turn enhances its antioridative stress impact which makes it protective to diseases such as cardiovascular and neurodegenerative diseases. This antioxidative action is essential in protecting cells against damage and in decreasing people's vulnerability to diseases.

Apart from its anti-inflammatory and antioxidant effects, Curcuma longa has rather impressive antimicrobial and immunomodulatory activity. Curcumin has an effect on immune cells' activity and cytokines synthesis which contributes to the improvement of immunity. Further, the compound also has a measure of antibacterial activity in this respect, this being another factor that enhances its versatility in treatment. Another highly researched possibility is that of the neuroprotective effect of Curcuma longa. By promoting the process of neurogenesis and protecting the neurons from degeneration Curcumin is thus credited for playing a part in the cognitive well being of an individual. This potential is particularly valid in treating neurological disorders such as Alzheimer's illness. Cardiovascular system also forms part of Curcuma longa's benefits. Curcumin has been known mediate antioxidant and anti-inflammatory effects to address issues related to oxidative stress and endothelial dysfunction, alter lipid profile and

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enhance the endothelial function. They tend enhance the abilities to prevent atherosclerosis and other related cardiovascular complications.

However, according to study, Curcuma longa has some positive impacts on gut health. Curcumin has an anti-inflammatory activity in the gut and is helpful in the relief of symptoms resulting from IBS. This feature also makes it capable of regulating the gut microbiota; thus, it exerts a positive effect on the gut health. In general, due to its wide range of pharmacological activities, Curcuma longa can be viewed as a promising object for pharmacotherapy. Further research has to be done to comprehend the deserve and prove the effectiveness of its usage in the contemporary practice of medicine.

II. OBJECTIVES

1. To execute a comparative anticancer potency of various extracts of Curcuma longa.
2. About the Extraction, Identification, and Evaluation of Anticancer Properties of Curcuma longa and Its Active Constituents.

III. METHODOLOGY

Sample Preparation

Ginger rhizomes from Curcuma longa was purchased and shade dried to about 6% of its initial weight. The dried rhizomes were then milled into a very fine particle size in order to enhance extraction efficiency.

Solvent Extraction

The powdered rhizomes were subjected to extraction using three different solvents: It has been dissolved in chloroform, ethanol, and a hydro-alcoholic mixture. As it can be shown, the type of solvent was distinguished based on the polarity level to test the efficiency of extraction.

1. Chloroform Extraction (CC1): About one gramme of powdered rhizomes were refluxed with chloroform (100ml) in soxhlet apparatus for 6hs.

2. Ethanol Extraction (EC1): Additional 10 grams of powdered rhizomes were extracted with ethanol (100 mL) employing the same Soxhlet procedure but for 6 h.

3. Hydro-alcoholic Extraction (CMW): A 10 gram sample of powdered rhizomes was extracted with a 100ml of hydroalcoholic solution (70% ethanol and 30% water) in Soxhlet apparatus for 6 hours.

The extracts were concentrated in a rotary evaporator after which the amount of extractive yield was measured.

Phytochemical Screening

Phytochemical screening was performed on the extracts to identify the presence of key compounds: It contains alkaloids, glycosides, saponins, flavonoids, terpenoids and many more. Determination of phytochemicals was done using the standard procedure for each class and the results obtained were noted as positive or negative for their presence.

Cytotoxicity Testing

The results of cytotoxicity studies of each extract were determined on several types of cells; carcinoma of the prostate (DU145), oral carcinoma (SCC29B) and normal kidney cells (Vero). Cell viability was assessed by an MTT assay to calculate the IC50 value which is equal to the concentration at which cell growth was reduced to a 50%. This assay gives an approximate measure of the inhibitory effect of each extract on cancerous and normal cells.

Curcuminoid Isolation

Extraction of curcuminoids was done from turmeric rhizomes with acetone as the extracting solvent. The process involved:

1. **Extraction:** Rhizomes powdered and weighed 20 grams they were extracted with acetone (100 mL) using a soxhlet extractor for 6 hours. The procedure was the same except that 40 grams of rhizomes were used.
2. **Isolation**: The acetone layer was evaporated, next curcuminoids were purified for further use with the help of column chromatography.
3. **Yield Determination:** Yield of curcuminoids from each batch was noted down and percentage yield was determined.

Data Analysis

Yields of extracts were determined based on the percentage of the fresh rhizome weight. In phytochemical screening, data on extracts was summarized in form of '+' and '-' indicating the presence and absence of compounds respectively. Cytotoxicity data were used for the comparison of the efficiency of each extract on different cell lineages. To check the reliability of the extraction process of curcuminoids, variation in the yield was also measured.

This way of working guarantees the clear assessment of the extractive and phytochemical

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characteristics of Curcuma longa, including the understanding about the solvents that should be work in the concentration of Curcuma longa bioactive compounds and their possible therapeutic perspective.

IV. RESULT & DISCUSSION

Extractive Yield of Curcuma longa

The results of yield of Curcuma longa rhizomes extracts with the help of various solvents mentioned in Table 1 show quite a variation in the extractive values obtained in different solvents:

- **Chloroform Extract (CC1):** 249 mg, which gives 2. 49%
- **Ethanol Extract (EC1):** Shan et al 2003 calculated the HPLC-DAD value to be at 1104 mg for which 11 was yielded. 04%
- **Hydro-alcoholic Extract (CMW):** 348 mg, which gives 3. 48%

Table 1 shows the extractive yields from different solvents

Solvent	Yield (mg)	Percentage (%)
Chloroform (CC1)	249	2.49
Ethanol (EC1)	1104	11.04
Hydro-alcoholic (CMW)	348	3.48

Phytochemical Screening

Table 2 summarises the content of the phytochemicals found in the extracts of Curcuma longa using three different solvents for extraction. The table categorizes the presence or absence of six key phytochemicals: such as alkaloids, glycosides, saponins, flavonoids, terpenoids and many others.

The findings were in a position to show a variation in chemical features of extracts in response to the sort of solvent utilized. It can be observed that, in the phytochemical screening, chloroform (CC1) has the ability to extract phytochemicals from the rhizomes, but it is incapable of doing it for all the selected phytochemicals, and in fact it has not extracted any of the phytochemicals being discussed in this study. By comparison, Ethanol (EC1) and hydro-alcoholic (CMW) extracts contain all the surveyed phytochemicals. That both ethanol and hydro alcoholic extract has the potential to extract a broad range of bioactive compounds from the turmeric rhizomes is evidenced by this consistent extraction on both solvents. Analytically speaking, the lack of phytochemicals in these chloroform extracts is a systematic variation from the set results of ethanol and hydro alcoholic extracts. Indeed, the presence of all the phytochemicals that has been tested in both the ethanol and hydro-alcoholic extracts substantiate the hypothesis that these solvents are more competent in the extraction process. This data indicates the effectiveness to ethanol and hydro-alcoholic solvents to extract several bioactive compounds which may be beneficial for the drug's use.

Table2 summarizes the phytochemicals present in each extract

Solvent	Alkaloids	Glycosides	Saponins	Flavonoids	Terpenoids	Others
Chloroform (CC1)	No	No	No	No	No	No
Ethanol (EC1)	Yes	Yes	Yes	Yes	Yes	Yes
Hydro-alcoholic (CMW)	Yes	Yes	Yes	Yes	Yes	Yes

Cytotoxic Studies of Curcuma longa

Table 3 presents the cytotoxicity profile of the different extracts against various cell lines:

- **Prostate Cancer (DU-145):**
  - Ethanol Extract (EC1): IC50=19). 88 µg/mL
  - Hydro-alcoholic Extract (CMW): Hence, the value of IC50 was estimated to be 53. 98 µg/mL
  - Chloroform Extract (CC1): IC50 = 1365. 47 µg/mL
- **Oral Cancer (SCC-29B):**
  - Ethanol Extract (EC1): IC50 = 11. 27 µg/mL

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- Hydro-alcoholic Extract (CMW): IC50 = 32. 22 µg/mL
- Chloroform Extract (CC1): The Sae2 IC50 is 426. 896 µg/mL

- **Normal Kidney Cells (Vero Cells):**
  - Ethanol Extract (EC1): Thus IC50 = 525 µg/mL.
  - Hydro-alcoholic Extract (CMW): IC50 = 16. 80 µg/mL
  - Chloroform Extract (CC1): FA50 =107. 915 µg/mL

Table 3 shows the IC50 values for each extract against different cell lines

Cell Line	Ethanol (EC1)	Hydro-alcoholic (CMW)	Chloroform (CC1)
Prostate Cancer (DU-145)	19.88 µg/mL	53.98 µg/mL	1365.47 µg/mL
Oral Cancer (SCC-29B)	11.27 µg/mL	32.22 µg/mL	426.896 µg/mL
Normal Kidney Cells (Vero)	525 µg/mL	16.80 µg/mL	107.915 µg/mL

Isolation of Curcuminoids

Table 4 shows the yield of curcuminoids extracted using acetone:

- **Acetone Extraction:**
  - First Batch: 3.2 g from 20 g of rhizomes (16.0% yield)
  - Second Batch: 6.4 g from 40 g of rhizomes (16.0% yield)
  - Total Yield: 9.6 g from 60 g of rhizomes

Table 4 shows yields of curcuminoids extracted with acetone

Batch	Amount Extracted (g)	Amount of Rhizomes Used (g)	Percentage Yield (%)
First	3.2	20	16
Second	6.4	40	16
Total	9.6	60	16

It was observed from the data given in Table 4 that the extraction efficiency of curcuminoids from turmeric rhizomes with the help of acetone was repeated in different batches. However, the percentage yield of curcuminoids is always constant 16% in all batches irrespective of the amount of rhizomes used. For the first batch, 3. From the first batch, 2 grams of curcuminoids were obtained from 20 grams of rhizomes and from the second 6 grams were obtained. 0. 04 g from 40 g of the rhizomes. From the 60g of rhizomes, the total yield was 9. Six grams, which is 16 per cent of the theoretical yield. The fact that a yield of about eight percent was obtained every time is an affirmation that the extraction by using acetone is feasible as well as accurate with the capacity to yield similar gains no matter the amount of raw material available. The relatively equal yield obtained means that acetone is a reliable solvent to extract curcuminoids especially when working at industrial scale so as to meet the large quantity demand and be economical.

V. CONCLUSION

Table 1 above shows the differences in the extractive yield values of Curcuma longa rhizomes when analysed using different solvents. The highest yield of the extract was obtained from ethanol extraction at 1104 mg per day contributing to 11. 04% of the total while hydro-alcoholic extraction gave the second best yield of 348 mg per day representing 3. 48%. This variation focuses on ethanol as the better solvent for the extraction of bioactive compounds from the rhizomes of

turmeric than chloroform solvent. Supported by data obtained from phytochemical analysis, mentioned in Table 2, one can draw this conclusion. Chloroform extracts that were obtained in this study were found to contain no detectable phytochemicals hence pointing to extraction capability of this solvent to be very low. Unfortunately, only glucose treatment is devoid of all the tested phytochemicals compared with all the tested phytochemicals present in both ethanol and hydro-alcoholic extracts. These regularity in the phytochemical content in the ethanol and hydro-alcoholic extracts confirms the efficiency of these solvents in the extraction of bioactive compounds.

In table 3 cytotoxicity profiles indicate that ethanol extracts have highest potential towards prostate and oral cancer cells by having low IC50 values as compared to hydro-alcoholic and chloroform extracts. This goes a long way in suggesting that the ethanol extracts is even more effective as an anticancer agent. Table 4 also establishes that acetone gives a standard 16% curcuminoids irrespective of the batch. Such consistence evidence further endorses the efficacy of using acetone in the extraction of curcuminoids in large scale operations.

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