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COMPARATIVE STUDY ON PHYTOCHEMICAL PROPERTIES OF TURMERIC AND GINGER

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Abstract :

Turmeric (Curcuma longa) and Ginger (Zingiber officinale Roscoe) rhizomes, both from Zingiberaceae family, had been studied for their physico/phytochemical and bioactive compositions, as a natural source of anti- microbial drugs. The active ingredients in turmeric and ginger were isolated using different solvents, such as, chloroform, ethanol, hexane and benzene, while rotary evaporator was used to separate the moisture contents, which were 12.38 and 11.15
% for both turmeric and ginger respectively. Ash contents were 7.45 % and 7.20 %, while, specific gravity was 0.34 % and 0.25 % for both turmeric and ginger respectively. Coumarin, the major content of turmeric was identified in all the solvent extracts, while, polyphenol was presence in ginger extracts. Saponin, terpenoids, and anthocynins, were found to be present in all the solvent extracts of both turmeric and ginger. Carbohydrates, protein and alkaloid contents were tested using standard methods.

Protein was identified in turmeric extract, but, not in ginger. The phyto-chemicals and bioactive compositions of turmeric and ginger have proved them source materials for drug formulations and antimicrobial agents, to fight against some pathogens and maintain some health challenges.

Keywords : Turmeric, ginger, phyto-chemicals, anti-microbial, solvent extraction

Introduction:

Recently, there is renewed scientific interest in investigation, isolation, identification and characterization of plants' bio-active chemicals, to combat disease causing pathogens that had proved resistance to already existing drugs, (Ali, 2008). Hence, researches and innovations on new anti-microbial agents from natural origins are of paramount importance. Formulation and development of unharnessed herbal concoctions, as a means of synthesizing new and improved antimicrobial pharmaceutical products is the major target of this research work. Studies had shown that the rate of resistance of microbes to already existing drugs and increased adulterated ones in our health systems had imposed great threat to human health. It had been expected that some phytochemical compounds from natural sources could be extracted, processed and used in the formulation of drugs for most allopathic or orthodox health treatments. It had been observed that many people from developing countries prefer

natural medicine to orthodox ones, due to their affordability, packaging, availability, lack of side-effect, etc.

Many phytochemicals from plants are directly or indirectly the backbone of traditional system of healing throughout the globe. World Health Organization had suggested that medicinal plants are the good source for variety of drugs can be used in treatment of some health issues (Swant and Godghate, 2013). Studies on the phytochemical compositions of some common herbs and plants had been preferred, due to their low cost, availability, and absence of side effects. A lot of reports had shown that natural products are playing great roles in modern drug development, especially for antibacterial and anti-tumour agents. A great number of plants' derivatives are important novel pharmacological active compounds to modern drug discovery and development, among which are Turmeric and Ginger. Some studies had shown that these plants have almost the same scientific classification, properties, anti-inflammatory and other therapeutic effects (Al-Suhaimi, et al, 2011).

Turmeric (Curcuma longa) and Ginger (Zingiber officinale Roscoe) are perennial rhizomes (root) of Zingiberaceae family, which are commonly used as spices, flavouring agents and for traditional medicine in many developing countries. (Kanjilal et al, 2002) and (Dixit et al, 2002) examined and characterized the morphological and chemical properties of turmeric. Curcumin, which is a natural phenol, had been reported as the major compound responsible for turmeric's bright yellow colour, (Dixit et al, 2002). Negi, et al (1999) isolated the yellow pigment from turmeric oleoresin and discovered the antibacterial activities against Bacillus aerus, Bacillus coagulus, Staphylococcus aureus, Eschericha coli and Pseudomans aeruinosa. (Sanatombi R. and Sanatombi, K. 2017) studied on the nutritional and bioactivity values of plants belonging to Curcuma genus and provided future perspectives for more research on the pharmaceutical applications for turmeric plants. Different species of turmeric had been discovered which are important for selection of genotype with higher yield and better quality.

Chemical analysis of ginger shows that it contains over 400 different compounds, (Demin, and Yingying, 2010). The major constituents in ginger rhizomes are carbohydrates, and phenolic compounds, according to the studies of (Park and Song, 2014). Ginger, which is a source of valuable phytonutrients, characterized by its aromatic odour and pungent taste. Researches had indicated that ginger and turmeric are effective in reducing inflammation in arthritic condition. (Neeru, et al 2013) reported extensively on the origin of ginger, cultivation, application in traditional medicine, in decorative, as antipoisoning agent, reduction of cholesterol, block excessive blood clothing, and fight against arthritis. Ginger rhizome may be used as digestive aid, anti-nausea remedy, control to baldness, reduce toothache, snake bite, help new born mothers cleanse their womb after child-birth, etc. The composition of ginger varies with the type, agronomic conditions, curing methods, drying and storage conditions (Rehman et al, 2011).

Aim and objective :

The major aim of this research is to isolate some phytochemical and physico-chemical compositions of turmeric and ginger rhizomes. Also, to compare their medicinal and therapeutic applications into some orthodox medicines. This innovation could help in formulation of some new antimicrobial agents to combat the resistance of some disease causing micro-organisms.

Materials and Methods :

➢ **Materials**

Some chemicals, reagents and materials used in this research work includes: Ethanol, methanol, hexane, and chloroform were gotten from Shri Sai College of Pharmacy Laboratory, Turmeric and Ginger rhizomes were bought from local market of Nagpur.

- **Turmeric: -**

Synonyms : Curcuma, curcuma aromatica, curcumin, curcuma longa, curcuminoid.

Biological source :

Turmeric is a product of curcuma longa, a rhizomatous herbaceous perennial plant belonging to the ginger family Zingiberaceae, which is native to tropical south Asia. As many as 133 species of curcuma have been identified worldwide.

Family : Zingiberaceae

Applications:-

1. Turmeric is used as a coloring agent.
2. It also has antimicrobial, antioxidant, and other useful properties.
3. It is quite useful in dentistry also.
4. According to the Indian Journal of Dental Research. Turmeric makes gums and teeth strong.
5. It can be used for relief from dental problems such as pain and swelling, gingivitis and periodontitis.

Ginger :-

Synonyms : Rhizoma zingiberis, Zingibere

Biological Source : Ginger consists of the dried rhizomes of the Zingiber officinale Roscoe.

Family: Zingiberaceae.

Applications :

1. Better Digestion.
2. Improves Immunity.
3. Alleviates PMS Symptoms.
4. Relieves Nausea and Upset Stomach.
5. May Help with Cancer.
6. Reduces Pain.
7. Healthier Skin.
8. Weight Loss Aid.

Preparation of Samples

Fresh rhizomes of ginger and turmeric were thoroughly washed separately, skinned, chopped into pieces, allowed to dry using an electric oven set at 45, and weighed at intervals, until constant weights were achieved. 1000 g of each samples was ground into powder after cooling, using an electric grinding machine and stored in two dry sample bottles for further analysis.

Physicochemical Analysis

The specific gravity, moisture content and percentage ash content were carried out on turmeric and ginger rhizomes according to standard. The parameters were calculated respectively using the formula below:

- Density (g / cm3) = $Weight\ of\ sample\ (g)\ /Volume\ (cm\ 3)$
- Moisture Content % = $W2-W1/W3-W2\times 100$
- Ash Content % = $W2-W1/W3-W2\times 100$

Phytochemical Analysis of Turmeric and Ginger

1. Sample preparation : 100 g of both turmeric and ginger rhizome powder were each soaked in 100 ml of ethanol, methanol, hexane and chloroform respectively. These were left for 72 hrs and were shaken at 2 hrs

intervals, using a shaking orbit machine. The mixture was filtered through a 0.45 µm nylon membrane filter. The extracts were evaporated to dryness under reduced pressure at 40ºC by a rotary evaporator. Each test sample of turmeric or ginger was labelled as TC (turmeric in chloroform); TE(turmeric in ethanol); TH(turmeric in hexane) and TM(turmeric in methanol) / GC(ginger in chloroform); GE (ginger in ethanol); GH (ginger in hexane) and GM(ginger in methanol), according to the solvent used in the extraction process. The phyto-chemical compositions of turmeric and ginger were each determined according to the standards of Amir et al., (2005), Sadeo and Amit (2015), and Arawande et al., (2013). Carbohydrate Content Using **Benetict's Test :** 2 ml of Benedict's reagent was added to 1 ml of the extract and boiled for 3 minutes. A reddish brown precipitate indicates the presence of carbohydrate (Reducing sugar). Reducing sugars are oxidized by the copper ion in solution to form a carboxylic acid and a reddish precipitate of copper (I) oxide.

2. Protein and Amino Acids (Biurret Test) - 1 % NaOH (Sodium hydroxide) solution was added to 1 ml of sample extract, followed by few drops of aqueous 1 % Copper (II) sulphate solution. The appearance a purple solution indicates the presence of protein.

3. Presence of Alkaloid (Mayer's Test) Test for alkaloids - 3 ml of 2 % HCl was added to 1 ml of turmeric and ginger solvent extracts. These mixtures were treated with few drops of Mayer's reagent (Potassium Mercuric iodine Solution) in different test tubes. Formation of a creamy white precipitate indicates presence of alkaloids.

4. (a) Presence of Tannins by Bromine water test - 2 ml of bromine water was added to 1 ml each of samples of turmeric and ginger extracted in different solvents. Decolouration of the bromine water, indicated the presence of tannins.

(b) Presence of Tannins using Ferric Chloride test - Few drops of 1 % ferric chloride solution was added to each sample extracts from the three solvents, brownish- green or blue- black colouration confirmed the presence of tannins.

5. Presence of Phenol using 10 % FeCI3 - 10 % of Ferric solution was prepared and diluted with 0.1 ml of NaOH solution, drop by drop until a permanent brown colour appeared. This solution was filtered and the filtrate used for the phenol test. I ml of the ferric solution was added into 5 ml of each sample extracts. Appearance of fresh bluish- black color indicates the presence of polyphenols.

6. Test for Steroids Steroid - 2 ml of chloroform and Conc. H2SO4 were added to 1 ml of solvent extracts of turmeric and ginger. Few drops of acetic acids were later mixed into the solution. Formation of greenish red coloration indicates the presence of steroids.

7. Presence Saponin Using Foam Test - 2ml of each plant extract was mixed with 5. 0 ml of distill water and shake vigorously for a stable frothing. Few drops of saturated oil (olive oil) were added to each mixture and shake very well. Appearance of emulsion (foam) after shaking indicates presence of Saponins.

8. Glycosides Determination Using Libermann's Test -To each extract, 2 ml of chloroform and concentrated acetic acid was added in an ice bath. Then 2 drops of concentrated H2SO4 was added. Formation of violent to the green colour indicates presence of glycoside.

9. Fixed Oil Using Paper/Spot Test - Drops of each concentrated extract were added separately in between two filter papers and kept undistributed. Oil stain on each paper indicates presence of oils and fats

10. Volatile Oil - 0.5 g of each extract was mixed with 1 ml of 0.1 M NaOH solution and 1 % aqueous HCl. Formation of white precipitate indicates presence of volatile oil.

11. Amino acid -1 ml of the sample extracts was each transferred into a test tube and 0.5 ml ninhydrin, was add on it and boil for 5 mins. Formation of a purple colour indicates the presence of amino acid.

12. Protein Contents Using Biurret Test -1 % NaOH (Sodium hydroxide) solution was added to the sample extract, followed by few drops of aqueous 1% Copper (II) Sulphate solution. The appearance a purple solution indicates the presence of protein.

13. Test for Starch -1 ml of each extract was placed in a test tube and 3 drops of iodine solution added, a deep blue or black colour shows presence of starch.

14. Coumarin - Evaporate 5 ml of ethanoic solution, dissolve the residue in 1- 2 ml at hot distilled water and divide the volume into two parts intense fluorescence indicate the presence of coumarin.

RESULTS AND DISCUSSIONS:

The results of the physicochemical values of turmeric and ginger rhizomes, gave the moisture content of 12.38 % and 11.15 % for turmeric and ginger respectively, as shown in Table 1. The ash content of 7.45 % for turmeric and 7.20% of ginger, were within acceptable range for plants of same family.

Table 1: Results on Physicochemical analysis of Turmeric and Ginger

Parameters	Turmeric	Ginger
Moisture content (%)	12.38	11.15
Ash content (%)	7.45	7.20
Specific gravity	0.34	0.25

Results on the phytochemical screening of solvent-extracts of turmeric and ginger are represented on Table 2 and 3 respectively. It was observed that terpenoids, saponins, and anthocynins, were present in all the solvent (chloroform C, ethanol E, Hexane H, and methanol M) extracts of both turmeric and ginger.

Table 2: Result on Phytochemicals in Turmeric Rhizomes

Parameter	TC	TE	TH	TM
Carbohydrate	++	++	-	++
Alkaloids	-	-	+	+
Flavonoids	+	+	-	++
Steroids	++	+	-	+
Amino acid	-	-	-	-
Starch	-	-	-	-
Protein	+	++	-	+
Tannins	-	++	-	++
Glycosides	-	+	++	-
Fixed oil	++	+	++	+
Volatile oil	-	++	-	+
Phenol	++	-	-	-

Note: TC is Chloroform extract of (turmeric); TE is ethanol extract,; TH is hexane extract; TM is methanol extract ; ++ is strongly positive; + is slightly positive and - is negative.

Table 3: Result on Phytochemicals in Ginger Rhizomes

Parameter	GC	GE	GH	GH
Carbohydrates	+	-	+	+
Alkaloids	-	++	+	+
Flavonoids	-	+	-	+
Steroids	+	+	+	-
Amino acid	-	-	-	-
Starch	-	-	-	-
Proteins	-	-	-	-
Tannins	-	+	-	+
Glycosides	-	+	++	-
Fixed oil	++	+	+	-
Volatile oil	-	+	-	-
Phenol	-	+	-	+

Note: GC is Chloroform extract (ginger); GE is ethanol extract; GH is hexane extract; GM is methanol extract; ++ is strongly positive; + is slightly positive; - is negative.

Turmeric and ginger rhizomes had been observed via our analytical mechanisms and results to be promising natural agent, in fighting aging and degenerative diseases. The use of different solvents

in this research is to determine the most suitable for isolation of bioactive compositions of the rhizomes, because, extracts from same plant may have different medicinal or therapeutic applications.

CONCLUSION:

There is an urgent need for evaluation of some herbal extracts from natural source, to substitute the already commercially produced antimicrobial agents, which has formed resistance to some diseases. The demand for unassessed natural products, with physico- and phyto-chemical compositions could result into more research on the best method of isolation, extraction, characterization, purifications, and application into pharmaceuticals, foods, or cosmetic formulations. The phytochemicals discovered in these plants could be suggested to pharmaceutical, cosmetics or food industries to be used for, as antimicrobial agents, antioxidants or additives.

The extractable phytochemicals from ginger and turmeric were observed to be a function of the solvents used. The overall assessment concludes that turmeric and ginger possess strong antibacterial, ant-thelmintic, anticancer, anti- parasitic, antiseptic, antioxidant, anti-inflammatory, anti-rheumatic, anti-tumor, anti-phlegmatic, antiviral properties. Further researches may be conducted by examining the anti-microbial activities of the solvent-extracts of ginger and turmeric so that the therapeutic usefulness of these extracts can be established.

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