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QUALITATIVE PHYTOCHEMICAL ANALYSIS OF TRADITIONALLY USED SPICES FROM INDIAN KITCHEN

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ABSTRACT

Spices are used as flavouring agents, preservatives and as home remedies in folk medicine. Spices have medicinal properties, which can be analysed by scientific investigation. Therefore the present study was aimed to investigate the phytoconstituents and percent yield in various solvent extracts of *Cuminum cyminum* (Jeera), *Nigella sativa* (Black jeera), *Piper nigrum* (Black Pepper), *Syzygium aromaticum* (Clove) and *Curcuma longa* (Turmeric) which are spices with medicinal value. The qualitative phytochemical screening / tests were carried out by using standard methods. Different solvent extracts of the five spices were tested for the presence of alkaloids, glycosides, phenolic compounds, tannins, phytosterols, saponins, proteins, carbohydrates, gums and mucilages. Phytochemical screening results were tabulated and percent yield of various solvent extracts was calculated using formula weight of dry extract/weight of dry spice powderx100.The initial phytochemical screening revealed the presence of important phytochemicals in all the five spices extracts. These phytochemicals might be responsible for the medicinal as well as nutritional value of the spices.

KEY WORDS

Phytochemical analysis, Spices, solvent extracts, alkaloids, glycosides, tannins, phenolics, proteins, carbohydrates

INTRODUCTION

The interest of consumers and researchers into how food and diet prevent and treat many disease conditions and promote human health has increased in recent years. The concept of food has gone beyond the supply of basic nutrients, to optimal nutrition-the capacity of food to over and above the supply of macro- and micro-nutrients, to promote health and well-being of individuals, reduce or prevent the risk of developing diseases and sometimes reverse them (Viuda-Martos et al., 2011 in Otunola GA 2021). A complex relationship exists between food, health, and humans. Naturally, foods provide normal growth and development, but recent trends have demonstrated that foods can also provide health benefits that co- exist with traditional medical approaches to disease treatment when fortified with phytonutrients. Foods beyond the basic nutritional functions have potential benefits to promote health, longevity and reduce the risk of diseases. A rapidly increasing area of research is that of functional foods and nutraceuticals also referred to as foods with physiological or health benefits (Myrie and Jones, 2011 in Otunola GA 2021).

Herbs and spices have been used for hundreds of years in cooking and medicine (Stephens 2010 in Sharma M *et.al* 2017). They add a wide range of flavors to food and may also provide health benefits. For some people, using herbs and spices in cooking may be a challenge (Cantwell, 2001 in Sharma M *et.al* 2017)

In whole world, India is the most recognized country for the spices and traditional medicine; these are having a wide range of physiological and pharmacological properties. A spice is a dried seed, fruit, root, bark or flower of a plant or a herb used in small quantities for flavor, color or as a preservative. Moreover, for people of the world, spices stimulate appetite and create visual appeals to food. All types of spices were use from the ancient time in our kitchen for daily so they fulfill the body requirements on routine basis. Many of these substances are also used in traditional medicines. Globalization has made these spices easily available, and increasing their popularity (Anupam KR Sachan et.al 2018)

Spices including Clove (*Eugenia caryophyllus*, family Mytraceae), Cinnamon (*Cinnamomum zylancium*, family Lauraceae), Black pepper (*Piper nigrum L.* family Piperaceae) Turmeric (*Curcuma longa* family Lauraceae) and Ajwain (*Trachyspermum ammi*, family Apiaceae) are effective against pathogenic bacteria. Spices have been recognized for their value of preserving foods and medicinal values due to the presence of bioactive antimicrobial compounds. (Shelef, 1983, Papp et al., 2007 in Sharma M. *et.al* ., 2017).

The use of spices and herbs (Table 1) dates back to time immemorial and transcends early civilization. In most cuisines, spices are used as adjuncts to flavor, color, or enhance the taste of foods. Because of their strong flavors, spices are used in small quantities and therefore do not add high amount of extra calories to the diet. However, some spices have considerably high protein, fats, carbohydrates, mineral elements, vitamins, and phytonutrients/phytochemicals contents; thus making them excellent sources of bioactive compounds which contribute to the total biological activity of the whole meal, thus providing means of managing degenerative

disorders and metabolic diseases (Bhathal et al., 2020). Addition of spices to foods have resulted in improved flavor, value addition, preservative effects and longer shelf-life. For example, garlic and red chili added to butterfat improved the flavor, red chili, fennel or clove are used for pickles, while improved storage stability of groundnut oil was effected with red chili and cinnamon leaves (Madsen and Bertelsen, 1995). Spices are also known to enhance digestion through the stimulation of digestive (pancreatic, terminal and small intestine) enzymes and secretion of bile, thus aiding the digestion and absorption of dietary fats (Platel and Srinivasan, 2000a; Platel and Srinivasan, 2000b; Srinivasan, 2005). The nutritional content of spices especially with regards to macro- and micro-nutrients are important and vary from spice to spice and is dependent on several factors which include the part of the plant, harvesting technique, processing method, vegetative state, and environmental conditions, amongst others (Ereifej et al., 2015). These authors reported that a study of selected spices from Jordan revealed that dry matter of spices could range from 83.6 to 92.4%; ash 4.5–10.4%; carbohydrates 4.5– 31%; protein 2.9–21.2%; fat 1.7–19.7; and fiber 25.7–59.2. Another study reported that on dry weight basis, the crude protein of spices and herbs could range from 4.6 to 22.1%; fat (ether extract) 7.5–36.0%, total carbohydrate 34.6–71.9% and free fatty acids (as percent oleic acid) were generally low indicating good storage stability, while the flavor imparting essential oils (as percent oleoresin) were fairly high and ranged from 0.1 to 5.2% (Achinewhu et al., 1995). These data indicate that spices can contribute nutrients to the diet.

Spices are also very important in food preservation and safety. They help to eliminate the risk of food spoilage caused by lipid oxidation and spoilage by microbes. Polyphenolic compounds in spices confer antioxidant properties which scavenge free radicals, chelate transition metals, quench singlet oxygen, and thus prevent oxidation in foods (Hyldgaard et al., 2012). Again, spices can prevent the growth of spoilage microorganisms (food preservation) and inhibit or regulate the growth of pathogenic organisms leading to food safety (Tajkarimi et al., 2010)

Herbs and Spices are harvested from different parts of the plant. Herbs are usually obtained from leaves of the plant while spices come from different seeds, root, bark, fruit, pods and flowers of the plant (herman,2015 in S.M. El-Sayed , A. M.Youssef 2019). Table 1.a summarizes the common sources of spices.

Table 1.a: Sources of Spices used for study

Part of the plant	Spices
Seed	Jeera, Nigella
Flower bud	Clove
Fruit	Pepper
Root	Turmeric

Spices have been used as flavor, color, aroma, enhancing agents and for preparation of food. These have been increasing studies on the role of spices as natural preservatives and for medicinal purpose. The influence of bioactive effects on health on selected spices are displayed in table 1.b.

Table 1.b: Bioactive functions of selected spices.(Anderson *et.al*., 1999 in S.M. El-Sayed, A.M.Youssef 2019)

Spices	Effect and function
Jeera	Rich in antioxidants and has antibacterial properties which assist in fighting of infection causing bacteria. Good source of potassium and iron which helps in building up our Immunity system.
Nigella sativa	Anti-inflammatory, anti-allergic, anti-tumor, hypoglycemic,anti-oxidant, hypotensive, hypolipidemic, immuno modulatory, nephroprotective, diuretic, anti-ulcer and hepatoprotective effects.it also regulates acne and menstrual cycle disorders and is used in the treatment of asthma.
Clove	It helps to fight against free radicals, which damage ourselves and can lead to disease. It is full of anti-oxidant.
Pepper	Increase fat burning (weight management). Help combat lungs, liver and prostate cancer.
Turmeric	Powerful anti-oxidant and help fight anti-oxidant damage in the body. Strong anti-inflammatory, fight Alzheimer‟s.

Spices and herbs can be categorized into several groups based on their flavor & color i.e., hot (Cayenne pepper, black & white peppers, mustard, chilies) slight flavor (coriander, paprika), aromatic spices (clove, cumin, dill fennel, nutmeg, mace, cinnamon) and aromatic herbs (thyme, marjoram, shallot, basil, bay leaf, onion, garlic). Based on color (turmeric) and herbaceous (sage, rosemary) or based on their taste such as sweet, bitter, spicy, sour, and sharp (Embuscado, 2015; Bhattacharyya et al., 2017).

The aim of the present study was to screen the phytochemicals of the medicinal spices *Cuminum cyminum*, *Piper nigum, Curcuma longa, Nigella sativa* and *Syzygium aromaticum* using different organic solvents like Methanol, Ethanol, Acetone, Ethyl acetate, Chloroform and also with Water. Percent yield of the spice extract in different solvents is to be measured. The study was carried out with the following objectives by using standard methods : the collection and authentication, Processing and extraction of spice samples, and Phytochemical screening and Calculation of Percent yield.

MATERIALS AND METHODS

SPICES COLLECTION

Collection and processing of spices (during June 2022) – The spices like jeera, nigella, clove, pepper were bought from the MORE SUPERMARKET, Doddaballapura taluk in packed form and turmeric was purchased from a local market.Then they were cleaned and ground into powder and stored in air tight containers until further use.

PREPARATION OF THE SPICE EXTRACTS

Fifteen grams of the powdered spice were weighed and added into 150ml of the organic solvents and water (1:10 w/v). The suspension was shaken vigorously for 5-10 minutes, then it was shaken a regular intervals manually and was left for over 48 hours at room temperature. After this the extract was filtered using Whatmann No.1 filter paper. The individual filtrates were poured into sterile petri plates for air drying at room temperature. The dried extracts were transferred into the eppendorf vials, sealed and stored at 4^0C until further use.

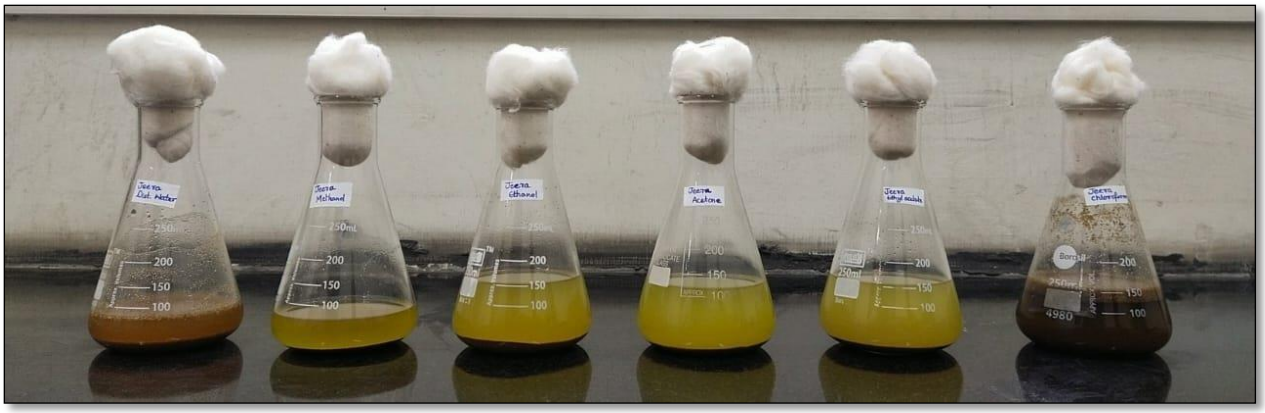

Fig 1: Preparation of jeera extract

Fig 2 : Preparation of Nigella extract

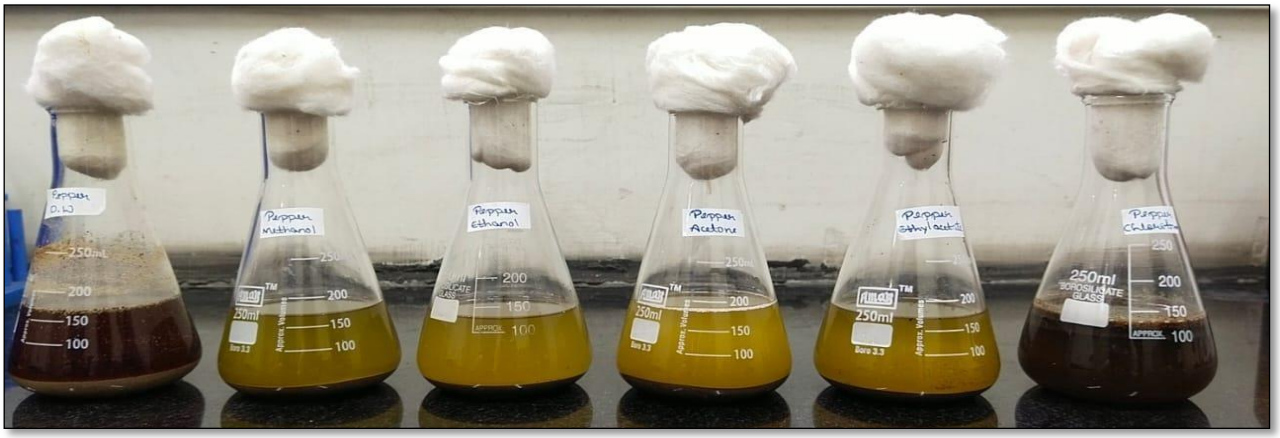

Fig 3: Preparation of Pepper extract

Fig 4: Preparation of Clove extract

Fig 5: Preparation of Turmeric extract

Chemicals used:

Absolute alcohol, Alkaline reagent test(10% ammonium hydroxide), Benedict‟s reagent (Sodium citrate + Sodium carbonate+ copper sulphate) , Biuret test(2% copper sulphate+ ethanol(95%)+ potassium hydroxide pellets, Ferric Chloride test(5%) , Distilled water, Lead acetate test(10%),. Libermann-Burchard‟s test(acetic anhydride+ concentrated sulphuric acid) , Mayer‟s reagent (mercuric chloride + potassium iodide), Millon‟s reagent (mercury + fuming nitric acid), Molish‟s reagent (alcoholic α –naphthol + conc.H_2SO_4), Solvents(distilled water, methanol, ethanol, ethyl acetate, acetone, chloroform). Wagner‟s reagent (iodine + potassium iodide),

Preliminary Qualitative Analysis according to standard procedures (Dr. L.Cathrine andK.Sahira Banu , 2015)

Test for Alkaloids

a. Mayer‟s test

To a few ml of plant sample extract, two drops of Mayer‟s reagent are added along the sides of testtube. Appearance of white creamy precipitate indicates the presence of alkaloids.

b. Wagner‟s test

A few drops of Wagner‟s reagent are added to few ml of plant extract along the sides of test tube. Areddish- Brown precipitate confirms the test as positive.

Test for Carbohydrates

a.Molish‟ s test

To 2 ml of plant sample extract, two drops of alcoholic solution of α- naphthol are added. The mixture is shaken well and few drops of concentrated sulphuric acid is added slowly along the sides of test tube. A violet ring indicates the presence of carbohydrates.

b.Benedict‟s test

To 0.5 ml of filtrate, 0.5 ml of Benedict‟s reagent is added. The mixture is heated on a boiling water bath for 2 minutes. A characteristic colored precipitate indicates the presence of sugar.

Test for Phenolic compounds and Tannins

a. Ferric Chloride test

The extract (50 mg) is dissolved in 5 ml of distilled water. To this few drops of neutral 5% ferricchloride solution are added. A dark green color indicates the presence of phenolic compound.

b. Lead acetate test

The extract (50 mg) is dissolved in of distilled water and to this 3 ml of 10% lead acetatesolution is added. A bulky white precipitate indicates the presence of phenolic compounds.

c. Alkaline reagent test

An aqueous solution of the extract is treated with 10% ammonium hydroxide solution. Yellow fluorescence indicates the presence of flavonoids

Test for phytosterols

a. Libermann-Burchard‟s test

The extract (50 mg) is dissolved in 2 ml of acetic anhydride. To this, 1 or 2 drops of concentrated sulphuric acid are added slowly along the sides of the test tube. An array of colour change shows the presence of phytosterols.

Test for Proteins

The extract (100 mg) is dissolved in 10 ml of distilled water and filtered through Whatmann No. 1filter paper and the filtrate is subjected to test for proteins.

a. Millon‟s test

To 2 ml of filtrate few drops of Millon‟s reagent are added. A white precipitate indicatesthe presence of proteins.

b. Biuret test

2 ml of filtrate is treated with 1 drop of 2% copper sulphate solution. To this 1 ml of ethanol(95%) is added, followed by excess of potassium hydroxide pellets. Pink colored ethanolic layer indicates the presence of protein.

Test for Saponins

The extract (50 mg) is diluted with distilled water and made up to 20 ml. The suspension is shaken in a graduated cylinder for 15 minutes. A two cm layer of foam indicates the presence of saponins.

Test for gum and mucilages

The extract (100 mg) is dissolved in 10 ml of distilled water and to this 2 ml of absolute alcohol is added with constant stirring. White or cloudy precipitate indicates the presence of Gums and Mucilages

RESULTS:

Table 2.a: Results for phytochemical analysis tests of Jeera

	JEERA	DISTILLED WATER	METHANOL	ETHANOL	ACETONE	ETHYL ACETATE	CHLOROFORM
1	**ALKALOIDS**						
a	MAYER‟S TEST	+	+	+	+	+	+
b	WAGNER‟S TEST	++	++	++	++	++	++
2	**CARBOHYDRATES**						
a	MOLISH‟S TEST	+	+	–	–	+	+
b	BENEDICT‟S TEST	++	++	+	+	+	+
3	**PHENOLIC AND TANNINS**						
a	FERRIC CHLORIDE TEST	+	+	+	–	+	+
b	LEAD ACETATE TEST	+	+	+	–	+	+
c	ALKALINE TEST	+	+	+	+	+	+
4	**PHYTOSTEROLS** LIBERMANN-BURCHARD‟S TEST	+	+	+	+	++	+
5	**PROTEIN**						
a	MILLON‟S TEST	–	+	+	+	+	+
b	BIURET‟S TEST	–	–	–	–	–	–
6	**SAPONINS**	+	+	–	+	+	+
7	**GUMS AND MUCILAGE**	–	–	+	+	+	–

(++): High presence , (+): Moderately presence , (-): Absence

Jeera expressed alkaloids, carbohydrates, phenols and tannins, phytosterols and saponins in distilled water. In methanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols, saponins and proteins were expressed. In ethanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols, gums and mucilages and proteins were expreessed. In acetone, alkaloids, phytosterols, saponins, gums and mucilages, carbohydrates, proteins and phenolic and tannins were expressed. In ethylacetate, alkaloids,phytosterols, carbohydrates, phenolic and tannins,

saponins, gums and mucilages and protein were expressed. In chloroform alkaloids, carbohydrates, phenolic and tannins, phytosterols, saponins and proteins were expressed.

PHYTOCHEMICAL ANALYSIS RESULT OF DIFFERENT EXTRACTS OF JEERA

Fig 6: Distilled water extract of jeera

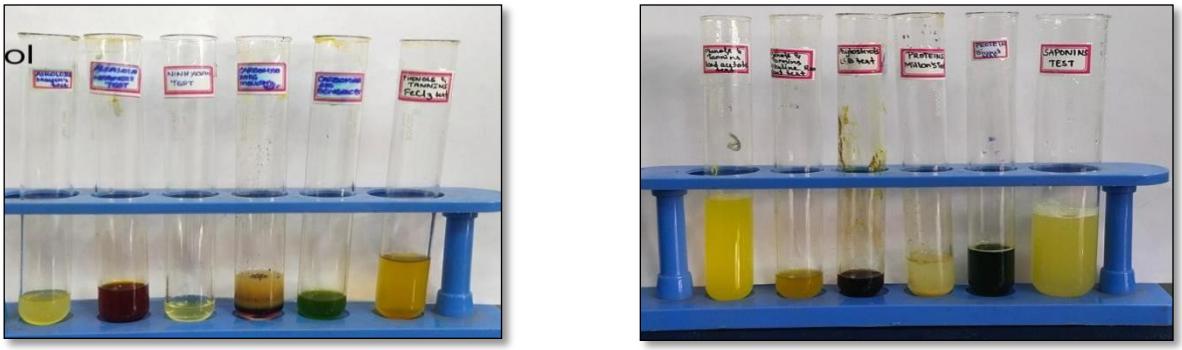

Fig 7: Methanol extract of jeera

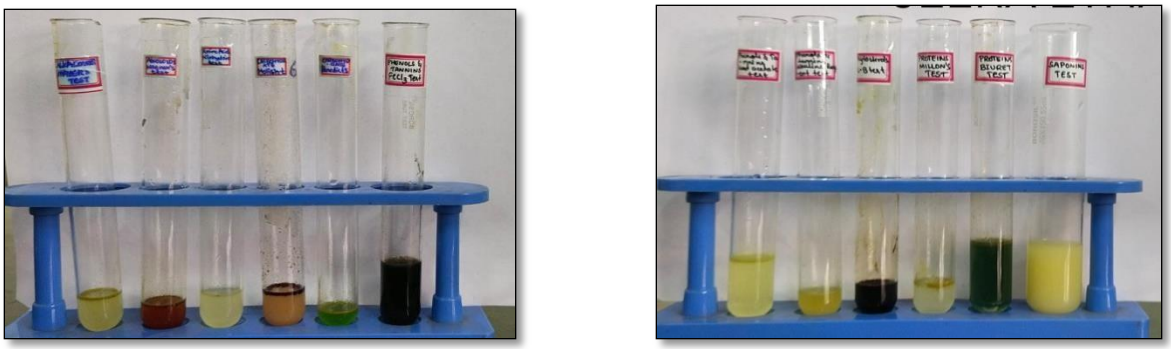

Fig 8: Ethanol extract of jeera

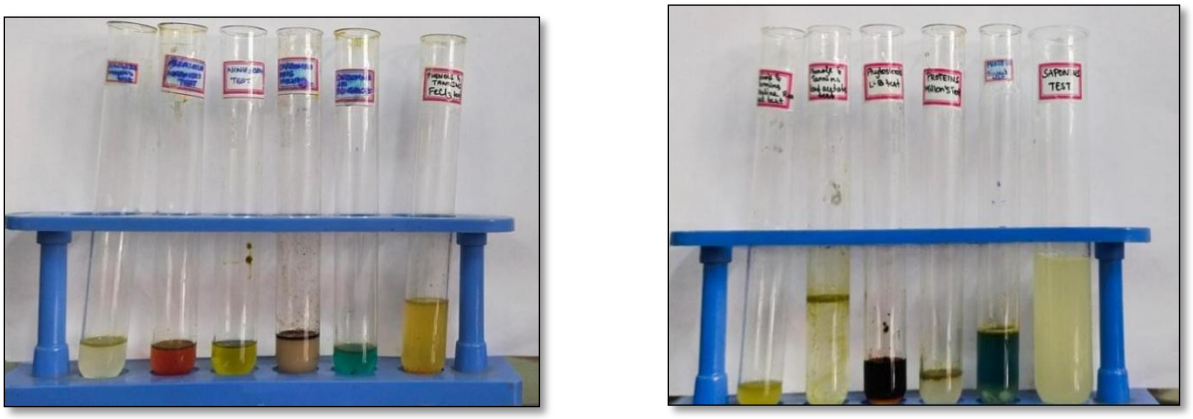

Fig 9: Acetone extract of jeera

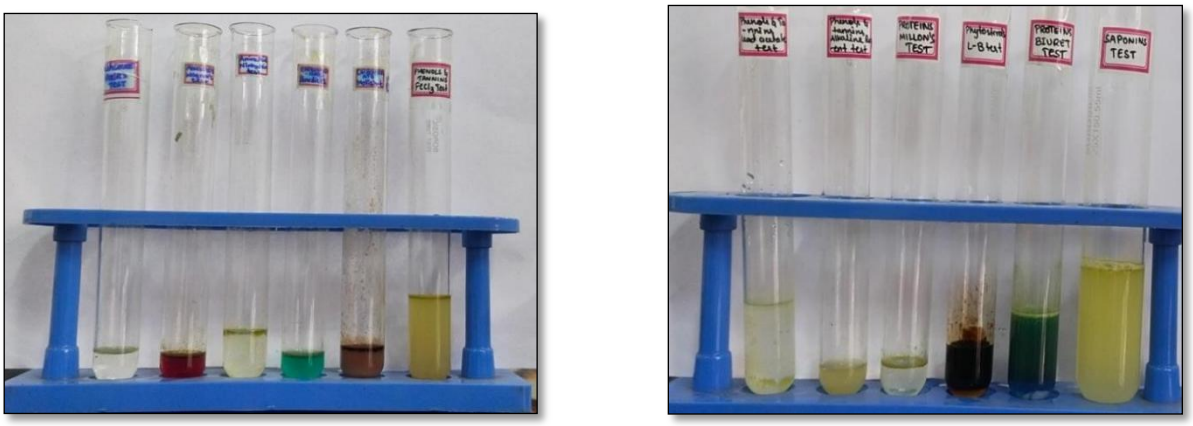

Fig 10: Ethyl acetate extract of jeera

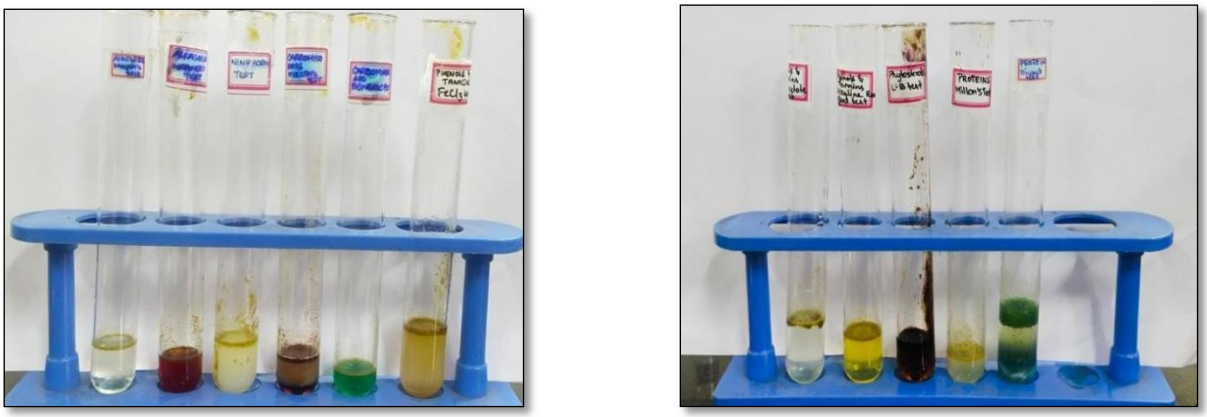

Fig 11: Chloroform extract of jeera

Table 2.b: Results for phytochemical test of nigella.

	NIGELLA	DISTILLED WATER	METHANOL	ETHANOL	ACETONE	ETHYL ACETATE	CHLOROFORM
1	**ALKALOIDS**						
a	MAYER‟S TEST	+	+	-	-	-	+
b	WAGNER‟S TEST	++	++	+	++	++	++
2	**CARBOHYDRATES**						
a	MOLISH‟S TEST	+	+	+	++	++	++
b	BENEDICT‟S TEST	+	+	+			
4	**PHENOLIC AND TANNINS**						
a	FERRIC CHLORIDE TEST	+	+	+	+	+	+
b	LEAD ACETATE TEST	+	++	+	+	+	+
c	ALKALINE TEST	-	+	-	-	-	+
5	**PHYTOSTEROLS** LIBERMANN-BURCHARD‟S TEST	+	++	+	+	+	+
6	**PROTEIN**						
a	MILLON‟S TEST	+	+	+	+	+	+
b	BIURET‟S TEST	-	-	-	-	-	-
7	**SAPONINS**	+	++	+	+	-	-
8	**GUMS AND MUCILAGE**	+	+	+	+	+	+

(++): High presence, (+): Moderately presence, (-): Absence

Nigella expressed alkaloids, carbohydrates, phytosterols, saponins, gums and mucilage, phenolic and tannin and protein in distilled water.In methanol, phenolic and tannin, phytosterol, saponins, alkaloids, carbohydrates, gums and mucilage and protein were

expressed. In ethanol,phytosterols, saponins, gums and mucilages, carbohydrates, phenolic and tannins,alkaloids and proteins were expressed. In acetone, alkaloids, phytosterols, saponins, gums and mucilages, carbohydrates, proteins and phenolic and tannins were expressed. In ethylacetate, alkaloids,phytosterols, carbohydrates, phenolic and tannins, gums and mucilages and protein were expressed. In chloroform alkaloids, carbohydrates, phenolic and tannins, phytosterols and proteins were expressed.

PHYTOCHEMICAL ANALYSIS RESULT OF DIFFERENT EXTRACTS OF NIGELLA

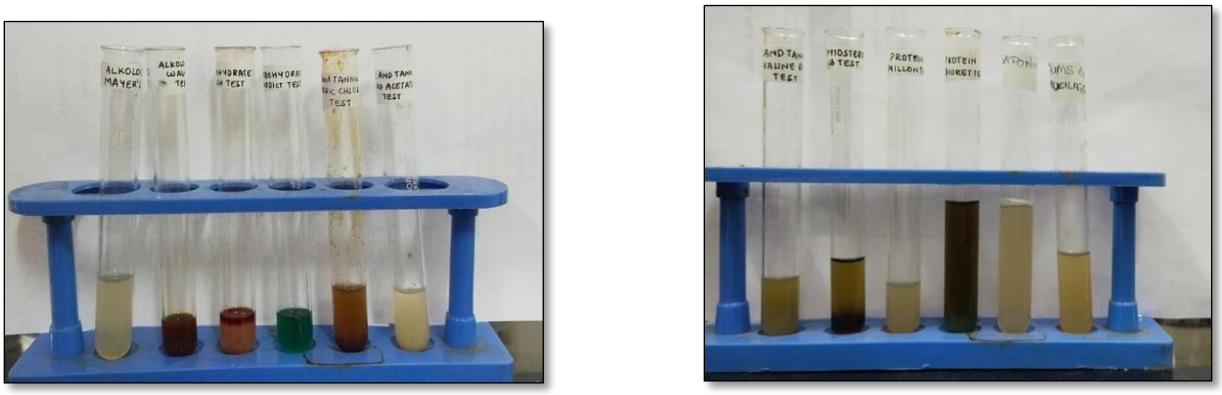

Fig 12: Distilled water extract of nigella

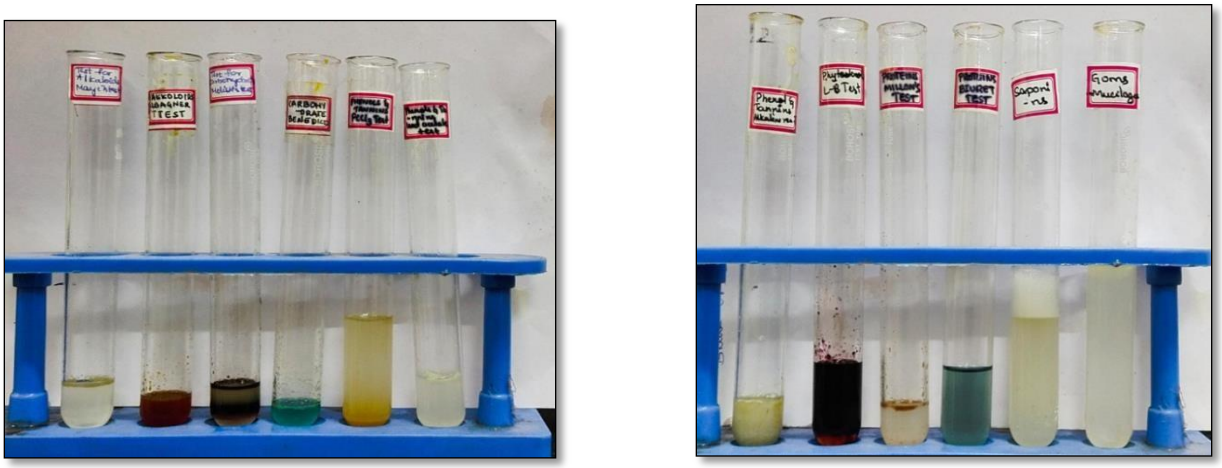

Fig 13: Methanol extract of nigella

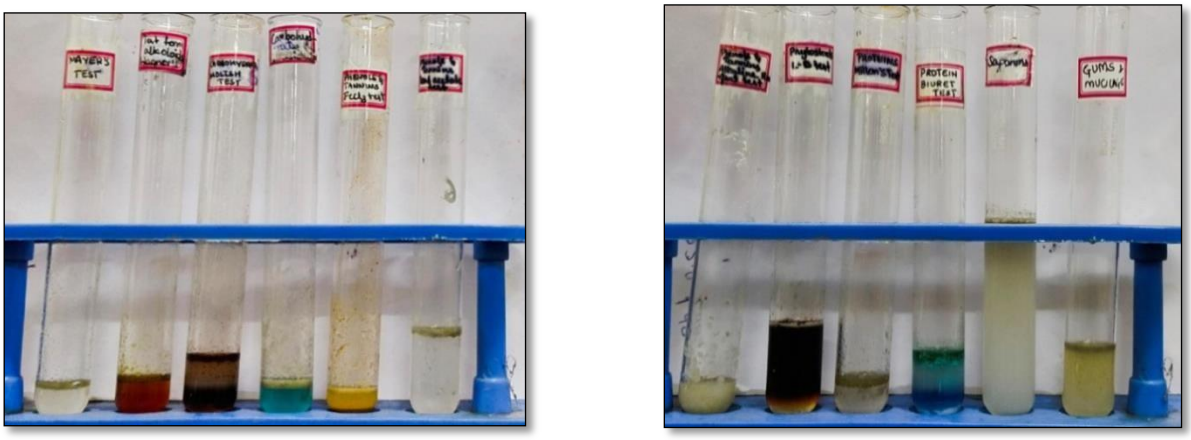

Fig 14: Acetone extract of nigella

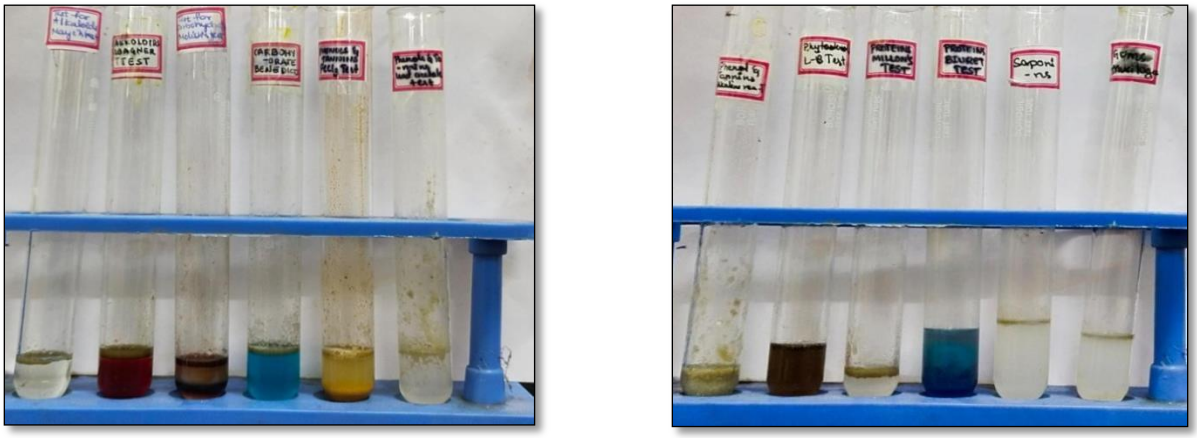

Fig 15: Ethyl acetate extract of nigella

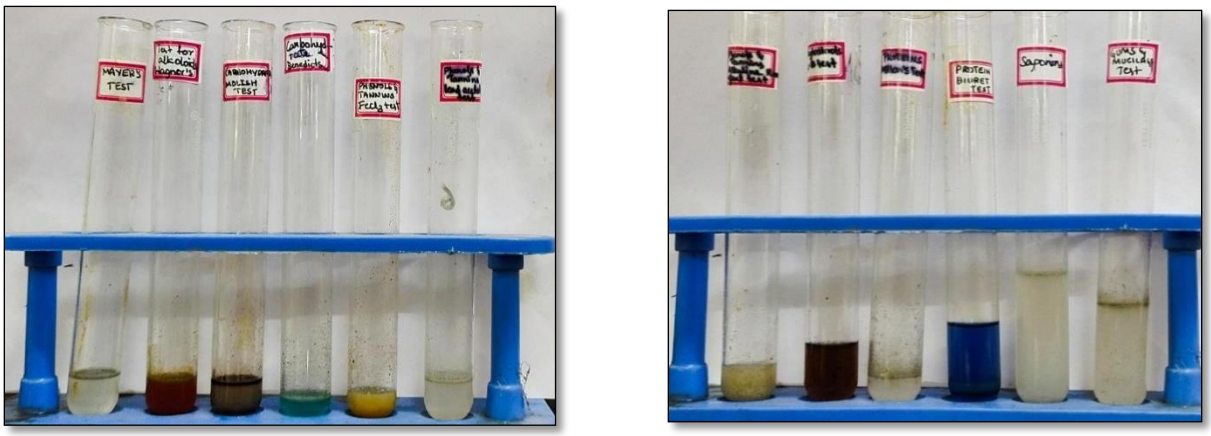

Fig 16: Chloroform extract of nigella

Table 2.c: Results for phytochemical test of pepper.

	PEPPER	**DISTILLED WATER**	**METHANOL**	**ETHANOL**	**ACETONE**	**ETHYL ACETATE**	**CHLOROFORM**
1 a	**ALKALOIDS** MAYER‟S TEST	+	+	+	+	+	-
b	WAGNER‟S TEST	++	++	++	++	++	+
2 a	**CARBOHYDRATES** MOLISH‟S TEST	-	+	+	+	++	+
b	BENEDICT‟S TEST	+	+	+	+	+	+
4 a	**PHENOLIC AND TANNINS** FERRIC CHLORIDE TEST	+	-	-	-	+	-
b	LEAD ACETATE TEST	+	+	+	-	+	-
c	ALKALINE TEST	+	+	+	-	+	+
5	**PHYTOSTEROLS** LIBERMANN-BURCHARD‟S TEST	+	+	+	+	+	+
6 a	**PROTEIN** MILLON‟S TEST	+	-	-	-	-	-
b	BIURET‟S TEST	-	-	-	-	-	-
7	**SAPONINS**	+	+	+	-	+	-
8	**GUMS AND MUCILAGE**	+	+	+	+	-	-

(++): High presence , (+): Moderately presence, (-): Absence

Pepper expressed alkaloids, carbohydrates, phenolic and tannins, phytosterols, gums and mucilages, protein and saponins in distilled water. In methanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols and saponins were expressed. In ethanol, alkaloids,

carbohydrates, phenolic and tannins, phytosterols, gums and mucilages were expreessed. In acetone, alkaloids, phytosterols, saponins, gums and mucilages and carbohydrates were expressed. In ethylacetate, alkaloids,phytosterols, carbohydrates, saponins, phenolic and tannins were expressed. In chloroform alkaloids, carbohydrates, phytosterols, phenolic and tannins were expressed.

PHYTOCHEMICAL ANALYSIS RESULT OF DIFFERENT EXTRACTS OF PEPPER

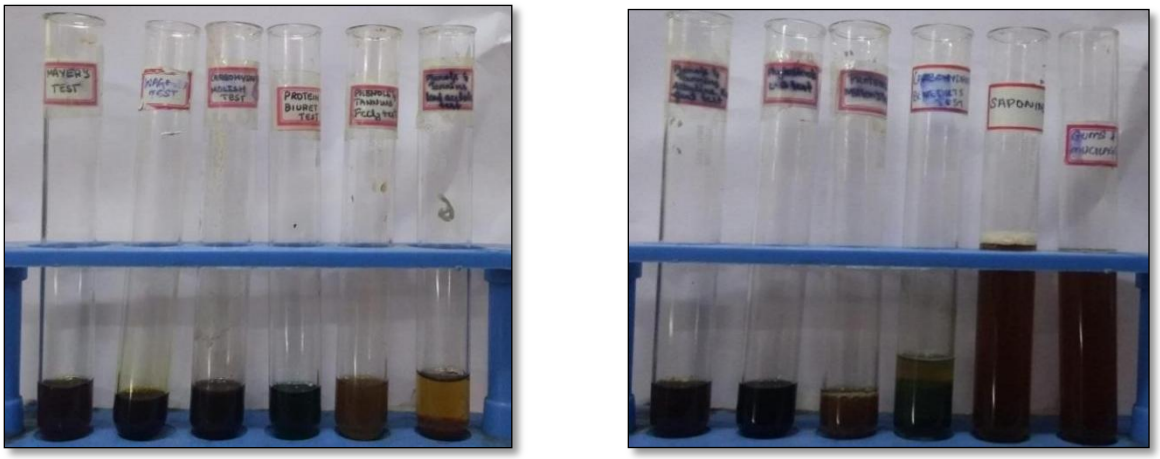

Fig 17: Distilled water extract of pepper

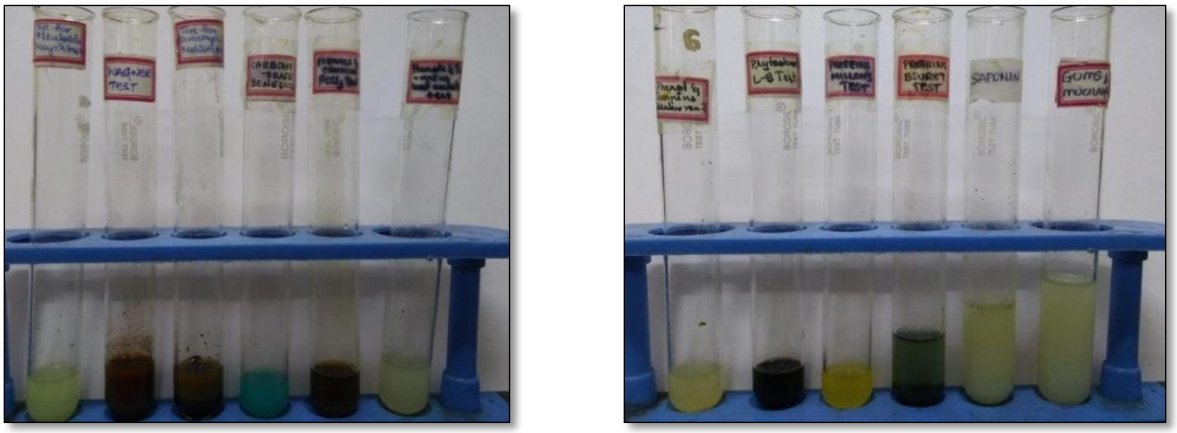

Fig 18: Ethanol extract of pepper

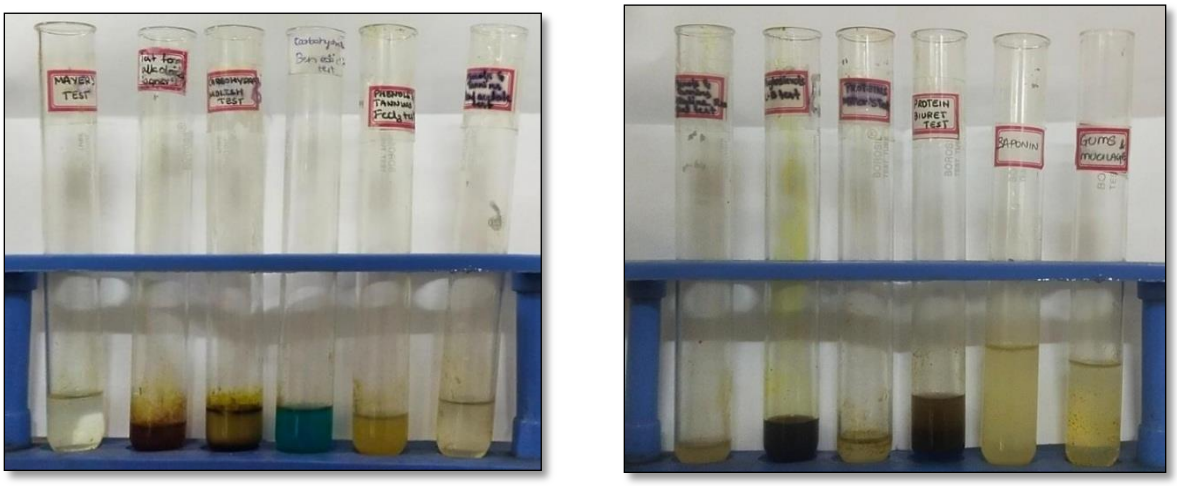

Fig 19: Chloroform extract of pepper

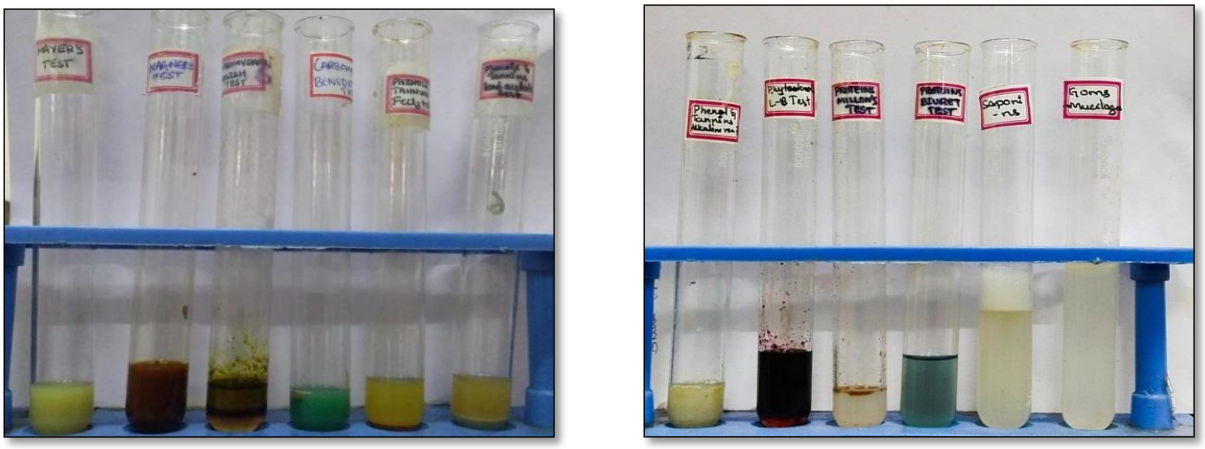

Fig 20: Ethyl acetate extract of pepper

Table 2.d: Results for phytochemical test of clove.

	CLOVE	DISTILLED WATER	METHANOL	ETHANOL	ACETONE	ETHYL ACETATE	CHLOROFORM
1	**ALKALOIDS**						
A	MAYER‟S TEST	+	+	+	-	-	+
B	WAGNER‟S TEST	++	++	++	+	+	+
2	**CARBOHYDRATES**						
A	MOLISH‟S TEST	+	++	+	++	+	++
B	BENEDICT‟S TEST	+	++	+	+	+	+
4	**PHENOLIC AND TANNINS**						
A	FERRIC CHLORIDE TEST	+	+	+	-	-	+
B	LEAD ACETATE TEST	++	++	++	++	++	+
C	ALKALINE TEST	+	+	+	+	+	+
5	**PHYTOSTEROLS** LIBERMANN-BURCHARD‟S TEST	++	+	+	+	+	-
6	**PROTEIN**						
A	MILLON‟S TEST	+	+	+	+	-	+
B	BIURET‟S TEST	+	-	-	-	-	-
7	**SAPONINS**	++	++	+	+	+	-
8	**GUMS AND MUCILAGE**	+	+	+	+	+	+

(++): High presence, (+): Moderately presence, (-): Absence

Clove expressed alkaloids, carbohydrates, phenolic and tannins, phytosterols, proteins,saponins, gums and mucilage in distilled water. In methanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols, saponins, proteins, gums and mucilage were expressed. In ethanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols,saponins, proteins, gums and mucilages were expreessed. In acetone, alkaloids, phytosterols, saponins, gums and mucilages, carbohydrates, proteins and phenolic and tannins were expressed. In ethylacetate, alkaloids,phytosterols, carbohydrates, phenolic and tannins, saponins, gums and mucilages were

expressed. In chloroform alkaloids, carbohydrates, phenolic and tannins, phytosterols andproteins were expressed.

PHYTOCHEMICAL ANALYSIS RESULT OF DIFFERENT EXTRACTS OF CLOVE

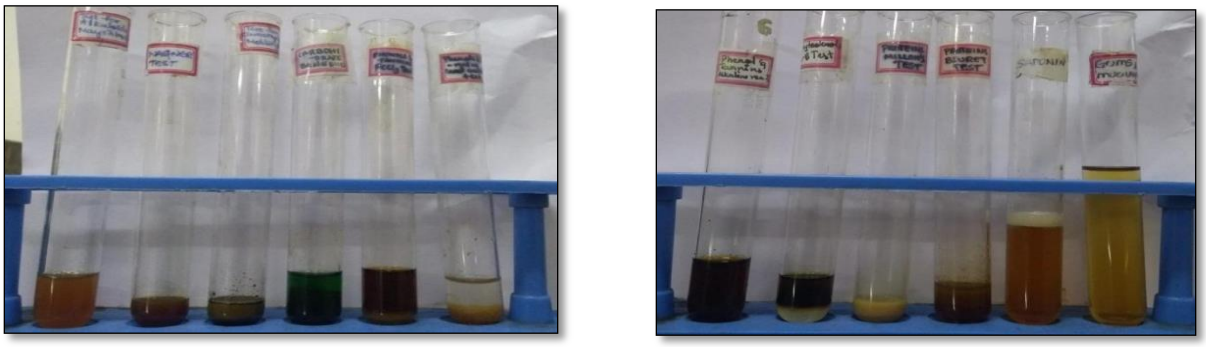

Fig 21: Distilled water extract of clove

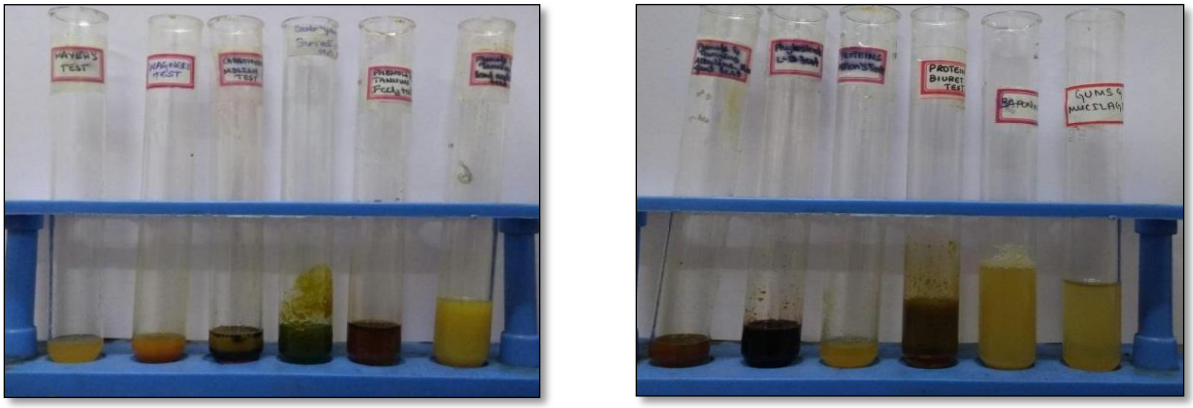

Fig 22: Methanol extract of clove

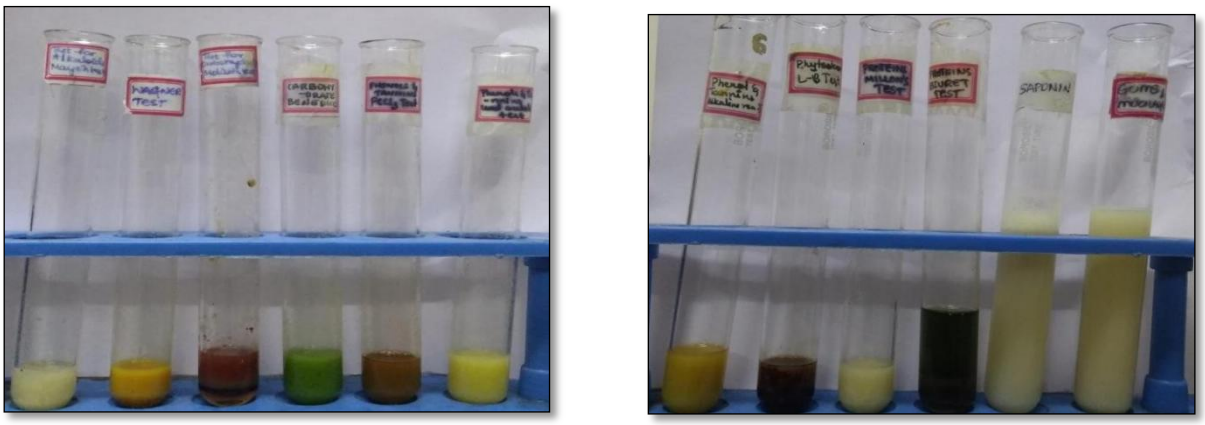

Fig 23: Ethanol extract of clove

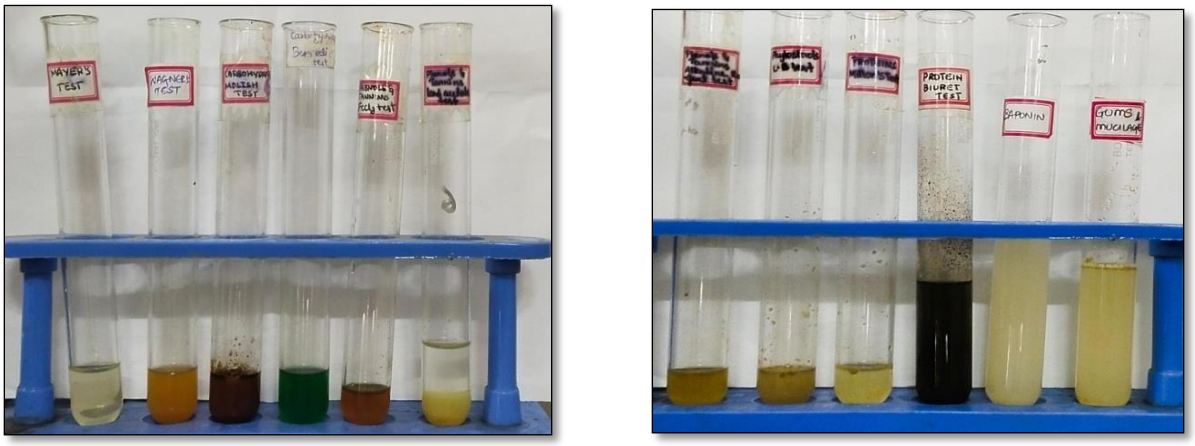

Fig 24: Ethyl acetate extract of clove

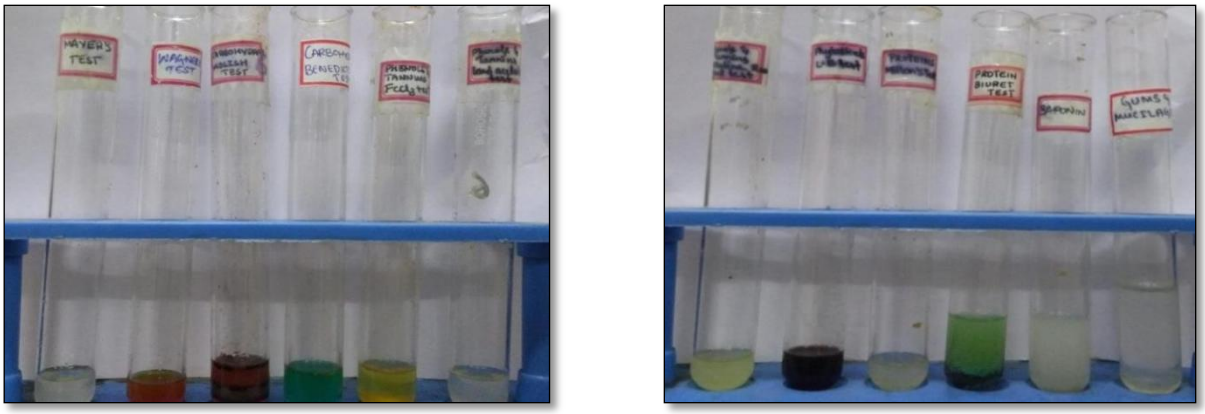

Fig 25: Chloroform extract of clove

Table 2.e: Results for phytochemical test of turmeric.

	TURMERIC	**DISTILLED WATER**	**METHANOL**	**ETHANOL**	**ACETONE**	**ETHYL ACETATE**	**CHLOROFORM**
1 a	**ALKALOIDS** MAYER‟S TEST	-	+	++	+	+	+
b	WAGNER‟S TEST	+	+	++	+	+	++
2 a	**CARBOHYDRATES** MOLISH‟S TEST	-	+	++	+	++	+
b	BENEDICT‟S TEST	+	+	+	+	++	++
4 a	**PHENOLIC AND TANNINS** FERRIC CHLORIDE TEST	-	-	-	+	-	-
b	LEAD ACETATE TEST	++	+	+	+	++	++
c	ALKALINE TEST	+	+	++	+	++	++
5	**PHYTOSTEROLS** LIBERMANN-BURCHARD‟S TEST	++	+	+	+	++	++
6 a	**PROTEIN** MILLON‟S TEST	+	+	++	+	+	+
b	BIURET‟S TEST	+	+	++	++	+	+
7	**SAPONINS**	+	+	+	+	+	+
8	**GUMS AND MUCILAGE**	+	+	++	+	+	++

(++): High presence, (+): Moderately presence , (-): Absence

Turmeric expressed alkaloids, carbohydrates, phenolic and tannins, phytosterols,proteins, saponins, gums and mucilages in distilled water. In methanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols, saponins, proteins, gums and mucilage were expressed. In ethanol, alkaloids, carbohydrates, phenolic and tannins, phytosterols, proteins, saponins, gums and mucilages were expreessed. In acetone, alkaloids, phytosterols, saponins, gums

and mucilages,carbohydrates, proteins, phenolic and tannins were expressed. In ethylacetate, alkaloids,phytosterols, carbohydrates, phenolic and tannins, saponins, proteins, gums and mucilages were expressed. In chloroform alkaloids, carbohydrates, phenolic and tannins, phytosterols, saponins, proteins, gums and mucilage were expressed.

PHYTOCHEMICAL ANALYSIS RESULT OF DIFFERENT EXTRACTS OF TURMERIC

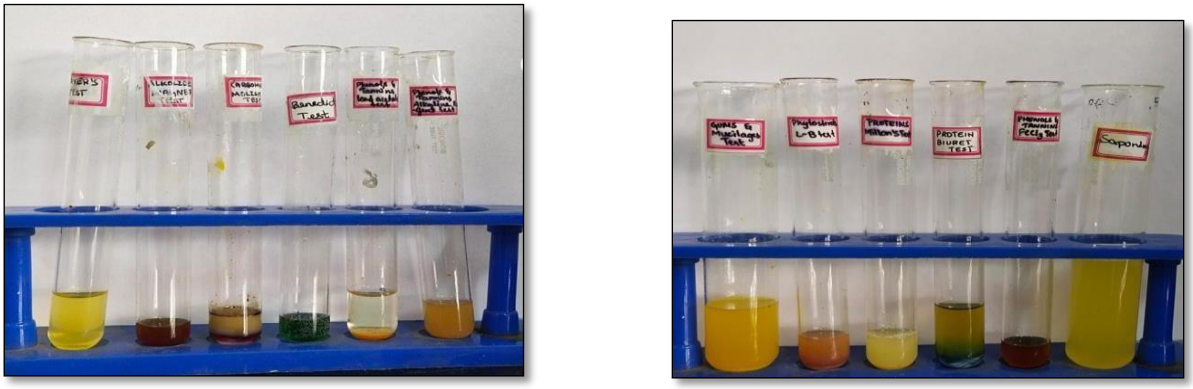

Fig 26: Distilled water extract of turmeric

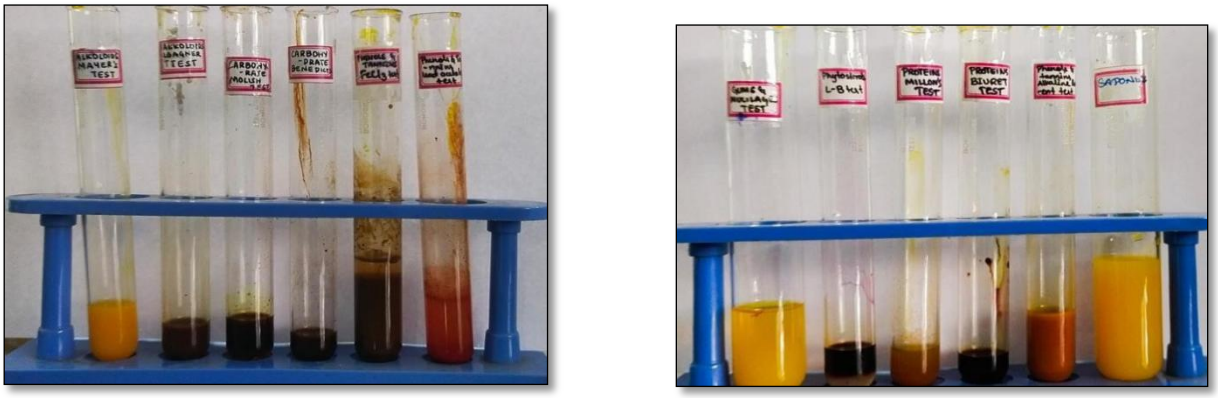

Fig 27: Ethanol extract of turmeric

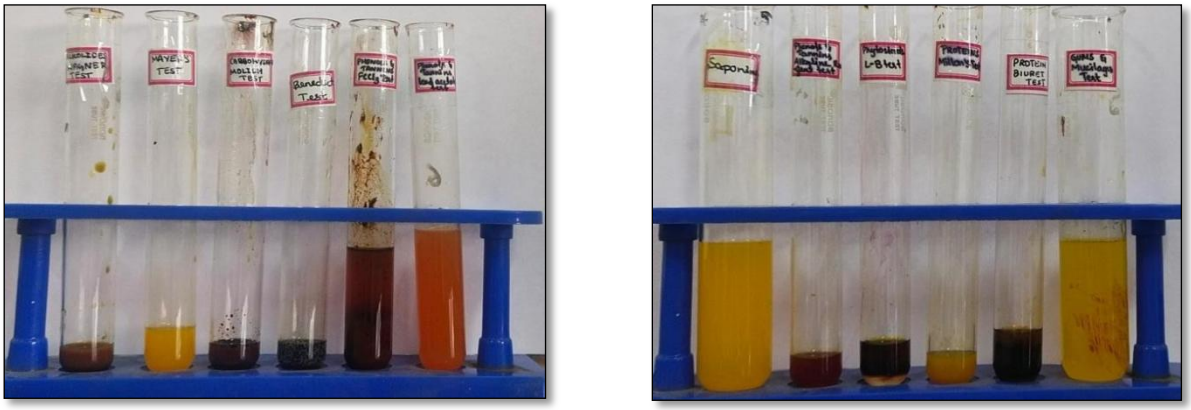

Fig 28: Acetone extract of turmeric

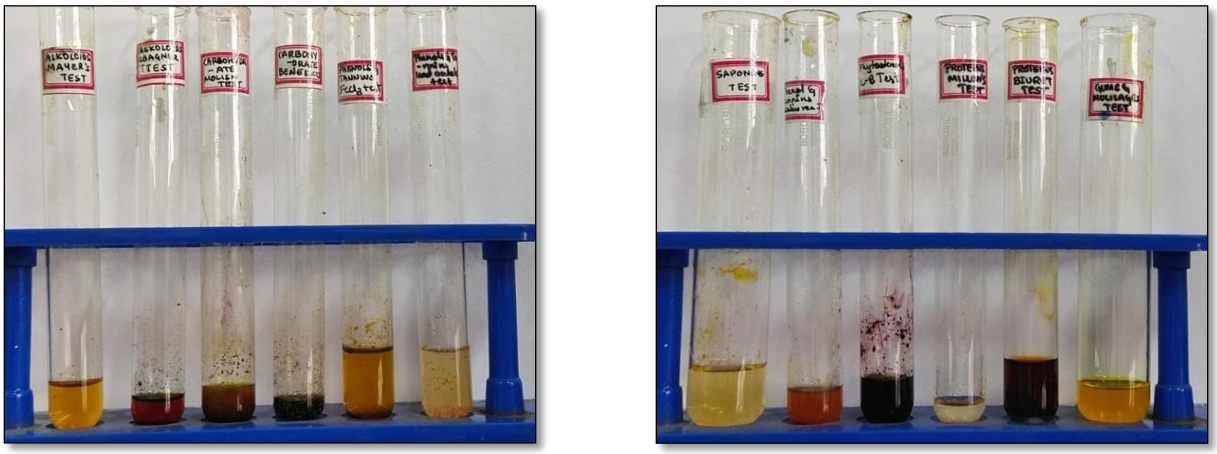

Fig 29: Ethyl acetate extract of turmeric

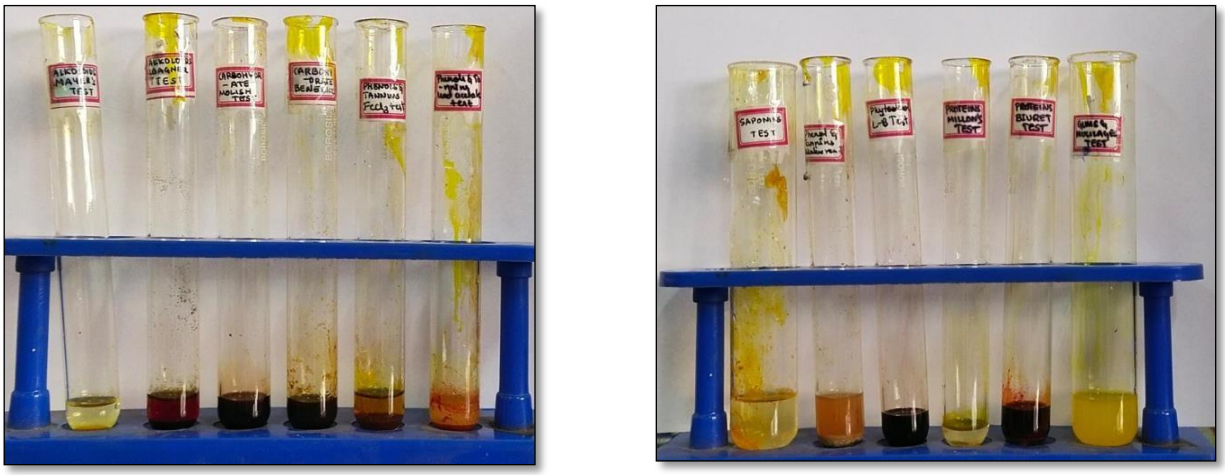

Fig 30: Chloroform extract of turmeric

Percentage of yield:

PERCENT YIELD = WEIGHT OF DRY EXTRACT/WEIGHT OF DRY SPICE POWDERX100

Table 3.a: Percent yield in Jeera

Sl No	SOLVENTS	% yield
1	Distilled Water	6.53
2	Methanol	9.86
3	Ethanol	6.13
4	Acetone	9.06
5	Ethyl Acetate	10.26
6	Chloroform	19.86

Table 3.b: Percent yield in Black jeera

Sl No	SOLVENTS	% yield
1	Distilled Water	7.46
2	Methanol	12.93
3	Ethanol	6.73
4	Acetone	6.46
5	Ethyl Acetate	8.80
6	Chloroform	16.53

Table 3.c: Percent yield in Pepper

Sl No	SOLVENTS	% yield
1	Distilled Water	13.40
2	Methanol	12.66
3	Ethanol	7.40
4	Acetone	11.40
5	Ethyl Acetate	7.20
6	Chloroform	14.86

Table 3.d: Percent yield in Clove

Sl No	SOLVENTS	% yield
1	Distilled Water	11.40
2	Methanol	8.20
3	Ethanol	7.13
4	Acetone	15.80
5	Ethyl Acetate	9.93
6	Chloroform	18.73

Table 3.e: Percent yield in Turmeric

Sl No	SOLVENTS	% yield
1	Distilled Water	13.40
2	Methanol	8.13
3	Ethanol	6.80
4	Acetone	12.13
5	Ethyl Acetate	10.06
6	Chloroform	19.26

DISSCUSSION

The phytochemicals like alkaloids, tanins, phenols , saponins etc are tabulated in tables for each medicinal spices in different solvents both organic and water. Each spice expresses differently in each solvents which are compared and discussed in which solvent the spices phytochemicals are present in high, moderate or absent and lowest amounts.

In Jeera, the phytochemicals expressed are tabulated in table 5.a which shows high presence in methanol compared to others and moderate presence in ethanol and acetone.

METHANOL> DISTILLED WATER> ETHYL ACETATE> CHLOROFORM> ETHANOL, ACETONE

In Nigella, the phytochemicals expressed are tabulated in table 5.b which shows high presence in

methanol and moderate presence in acetone.

METHANOL> CHLOROFORM> DISTILLED WATER> ETHANOL> ETHYL ACETATE> ACETONE

In Pepper, the phytochemicals expressed are tabulated in table 5.c which shows high presence in distilled water and low in chloroform.

DISTILLED WATER> METHANOL> ETHANOL> ETHYL ACETATE> ACETONE> CHLOROFORM

In Clove, the phytochemicals expressed are tabulated in table 5.d which shows high presence in distilled water and methanol and low in ethyl acetate.

DISTILLED WATER> METHANOL> ETHANOL> CHLOROFORM> ACETONE> ETHYL ACETATE

In Turmeric, the phytochemicals expressed are tabulated in table 5.e which shows high presence in ethanol and low in methanol.

ETHANOL> CHLOROFORM, ETHYL ACETATE> ACETONE> DISTILLED WATER> METHANOL

The more yield or presence of phytochemicals in methanol may be due to the polar nature of the solvent.

CONCLUSION

The present work was aimed to carry out phytochemical analysis of different solvent extracts of five selected spices, following standard procedures. The overall qualitative phytochemical screening revealed the presence of different important phytochemicals like alkaloids, saponins, phenols and tannins, etc.. in the five spices studied.

It can be concluded that most expressive organic solvent was methanol compared to others andthe least ones were ethanol and acetone. The spice which expressed large amount of phytochemicals was turmeric compared to clove, nigella, pepper and jeera. Only in the case ofturmeric the methanol was less expressive than ethyl acetate and acetone.

The percentage of spice yield was comparatively more in turmeric, it can be used to study phytochemicals in large quantity and also in detailed manner.

We have employed six number of different solvents for extraction and phytochemical screening,this data might be useful for further studies.

Based on our work, the future recommendation of the study inlcudes

a) Quantitative estimation of different important phytochemicals and also theircharacterization by HPTLC, GC-MS, HPLC etc.

b) Pharmacological activity testing(by both *in-vitro* and *in-vivo* methods) of thephytochemicals from the spice extract.

c) Molecular docking studies etc.

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