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A study on phytochemical analysis of homoeopathic mother tincture *Azadirachta indica*

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Abstract
Medicinal plants play an important role in traditional and complementary systems of medicine due to their rich phytochemical composition and therapeutic potential. *Azadirachta indica* (Neem) is a well-known medicinal plant extensively used for its antidiabetic, antimicrobial, anti-inflammatory, and antioxidant properties. Homoeopathic mother tinctures prepared from medicinal plants retain biologically active phytoconstituents that contribute to their therapeutic efficacy. The present study aimed to qualitatively evaluate the phytochemical constituents present in homoeopathic mother tincture of *Azadirachta indica*. The mother tincture was subjected to standard qualitative phytochemical screening tests to detect the presence of major secondary metabolites such as alkaloids, glycosides, saponins, phytosterols, phenolic compounds, and tannins. The results revealed the presence of all the above-mentioned phytoconstituents in the tested mother tincture, indicating a rich phytochemical profile. The presence of these bioactive compounds may account for the wide range of pharmacological activities attributed to *Azadirachta indica* in homoeopathic practice. The findings provide scientific support for the traditional use of *Azadirachta indica* and emphasize the need for further quantitative and advanced analytical studies to explore its therapeutic potential.

Keywords: *Azadirachta indica,* neem, homoeopathy, mother tincture, phytochemical screening

Introduction
Medicinal plants constitute an important source of therapeutic agents in both traditional and modern healthcare systems due to their diverse phytochemical composition and wide range of biological activities [1]. *Azadirachta indica* A. Juss, commonly known as Neem, is a medicinal plant native to the Indian subcontinent and has been extensively used in Ayurveda, Unani, Siddha, and homoeopathic systems of medicine for the management of various ailments [2, 3]. Neem possesses several pharmacological properties including antidiabetic, antimicrobial, anti-inflammatory, antioxidant, antiviral, and anticancer activities, which have been attributed to the presence of bioactive constituents such as alkaloids, flavonoids, glycosides, tannins, saponins, and phytosterols [3-5]. Homoeopathic mother tinctures are hydroalcoholic extracts prepared from fresh plant material following standardized pharmacopeial methods and are known to retain therapeutically active phytochemicals responsible for medicinal action [6]. Phytochemical screening serves as an essential preliminary tool for the scientific validation of medicinal plant preparations and provides a foundation for further pharmacological and analytical investigations [7]. In this context, the present study was undertaken to qualitatively evaluate the phytochemical constituents present in homoeopathic mother tincture of *Azadirachta indica*.

Materials and Methods
Procurement of drug
Homoeopathic mother tincture of *Azadirachta indica* (Q) was commercially purchased from Willmar Schwabe India Pvt. Ltd.

Reagents used
Picric acid solution, Mayer's reagent, Dragendorff's reagent, iodine solution, sodium hydroxide solution, concentrated sulphuric acid, sulphur powder, and distilled water were used for phytochemical screening.

Qualitative phytochemical screening
Standard qualitative chemical tests were performed to identify the presence of major phytoconstituents in *Azadirachta indica* mother tincture following established protocols [9-11].

Test for alkaloids
Mayer's test: To a few ml of *Azadirachta indica* Q, two drops of Mayer's reagent are added along the sides of test tube. Appearance of white creamy precipitate indicates the presence of alkaloids [10].

Dragendroff test: To 5ml of *Azadirachta indica* Q, 2ml of HCl was added. Then 1 ml of Dragendroff's reagent was added an orange or red precipitate shows a positive result for alkaloids [11].

Iodine test: To 3ml of *Azadirachta indica* Q, few drops of iodine solution was added A blue colour, which disappears on boiling and reappears on cooling shows a positive result for alkaloids [12].

Picric acid test: To 3mL *Azadirachta indica* Q, Add 3-4 drops of 2% picric acid solution. An orange colour shows a positive result for alkaloids [15].

Test for saponin
Foam test: To few ml of *Azadirachta indica* Q add 2ml water and shake vigorously. The formation of stable foam for 10mins was taken as an indication for the presence of saponins [13].

Test for glycoside
Aqueous Naoh test: To few ml of *Azadirachta indica* Q add 1ml of water and few drops of aqueous NaOH solution. A yellow colour indicates the presence of Glycoside [12].

Test for phytosterols
Salkowski's test: To few ml of *Azadirachta indica* Q, add few drops of conc. H_2SO_4 (Shaken well and allowed to stand). Red colour in lower layer indicates the presence of Phytosterols [14].

Sulphur test: To few ml of *Azadirachta indica* Q, Add a pinch of sulphur powder. Sulphur sinks to the bottom indicates the presence of Phytosterols [12].

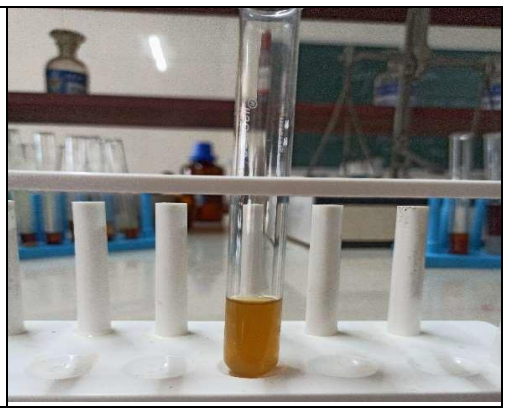
Test for phenolic compounds
Iodine test: To 1ml of *Azadirachta indica* Q, Add few drops of dil. Iodine sol. A transient red colour indicates the presence of iodine test [12].

Test for tannins
10% Naoh test: To 0.4mL of *Azadirachta indica* Q, Add 4ml of 10% NaOH and shaken well. Formation of emulsion {Hydrolysable tannins}. Indicates the presence of iodine test [12].

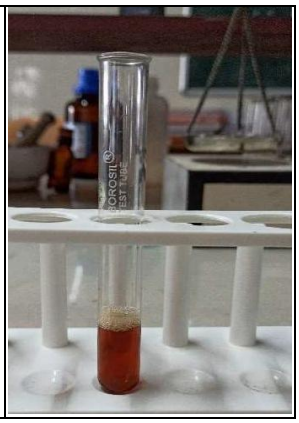
Results
Test for alkaloids

1. Picric acid test	An orange colour - present	
2. Mayers test	A creamy white/yellow precipitate - Absent	
3. Iodine test	A blue colour, which disappears on boiling and reappears on cooling - Absent	
4. Dragendroff test	A reddish-brown precipitate - Present	

Test for glycoside

Aqueous NaOH test	Yellow colour present	

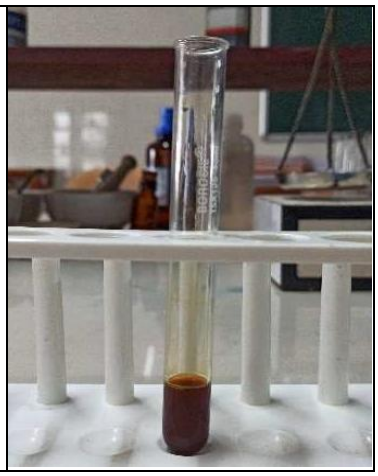
Test for saponin

Foam test	Persistent foam for 10 min - Present	

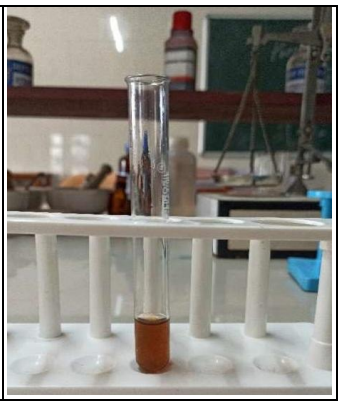
Test for phytosterols

Salkowski's test	Red colour (in lower layer) - Present	
Sulphur test	Sulphur sinks to the bottom - Present	

Test for phenolic compounds

Iodine test	A transient red colour - Present	

Test for tannins

10% NaOH test	Formation of emulsion {Hydrolysable tannins}	

The preliminary phytochemical tests performed were of qualitative type and from the phytochemical investigations it was observed that alkaloids, tannins, phenolic compounds, phytosterols, saponins, Glycoside were present in the *Azadirachta indica* Q.

Discussion

Neem (*Azadirachta indica*) elaborates a vast array of biologically active compounds which are structurally complex and chemically diverse. Every part of this plant is used as herb. During the past two decades, the chemical constituents and biological activities of *Azadirachta indica* were intensively investigated in both developing and developed countries. Several published studies revealed a lot of biological compounds [16]. From the preliminary phytochemical tests performed it was observed that alkaloids, tannins, phenolic compounds, phytosterols, saponins and Glycoside were present in the *Azadirachta indica* mother tincture. According to the Ani and Okolie (2018), the highest concentration of alkaloids %, flavonoids%, terpenoids %, saponins % was seen in the leaves of A. indica than the Stem-bark and root. Biu *et al*. (2009) reported that aqueous leaf extract of A. indica possesses higher amount of saponins and low quantity of alkaloid which corroboration with the result [17]. The TLC running with the hydro-alcoholic A. indica extract and pure standard flavonoids in co-chromatography indicated that astragalin, quercitrin, isoquercitrin, nicotiflorin and rutin were the only flavonoids found in the hydro-alcoholic extract among those screened [18]. On the basis of the LC-MS the known compounds, 10 compounds (4 terpenoids, 1 alkaloid, 2 flavonoids, 2 lignins, 1 saponin) were identified from 80% ethanolic extract of *Azadirachta indica* [19]. Two novel natural metabolites, 3-O-butyl-(-)-epicatechin and 3O-butyl-epigallocatechin, as well as several known substances, epicatechin, gallocatechin epigallocatechin, azadirachtin A, trilinolein and octadecanoic acid-tetrahydrofuran-3,4-diyl ester, were isolated from the bark of *Azadirachta indica* [20].

Conclusion

The result revealed the presence of phytoconstituents in *Azadirachta indica* mother tincture. Many earlier studies gathered which confirmed of phytochemicals to be bioactive. Further studies like Quantitative analysis, Chromatography techniques and GCMS Technique are to be conducted.

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