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ORIGINAL STUDY

Development of TLC Fingerprinting Profile of *Shadanga Paniya* – An Ayurvedic Formulation to Treat Symptoms of COVID-19

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Abstract

Background: *Shadanga Paniya* is a compound Ayurvedic formulation that contains six ingredients. Ayurvedic Physicians have been using *Shadanga Paniya* to treat fever for ages. Symptoms of COVID-19 are also being treated by *Shadanga Paniya*. However, the *Shadanga Paniya* has not reported standardisation.

Aims: To prepare *Shadanga Paniya* as per the standard classical protocol. To carry out qualitative tests, standardisation and TLC profile development for *Shadanga Paniya*.

Materials and methods: All the ingredients of *Shadanga Paniya* viz. *Nagarmotha*, *Pittapapada*, *Khasa*, *Lal Chandana*, *Sugandhbala* and *Sunthi* were taken in equal amounts. All these ingredients are heated over mild heat with water. The filtration of liquid *Shadanga Paniya* is carried out after completing proper deduction. *Shadanga Paniya* was subjected to organoleptic tests. Qualitative tests, physicochemical parameters and thin layer chromatography studies were also carried out. The comparative TLC studies of *Shadanga Paniya* was carried out with its ingredients.

Results: Organoleptic tests of *Shadanga Paniya* showed that the colour of the liquid was reddish-brown, and the liquid was clear. It has a characteristic odour with an astringent taste. Qualitative analysis showed the presence of flavonoids, carbohydrates, saponin, phenols and glycosides. Test sample parameters revealed a total solids content (0.812% w/v) and specific gravity (1.0083). The test sample has a Refractive index (1.334) and pH (4.2). The Thin Layer Chromatography study exhibited 3 bands at 254 nm and 366 nm. After spray, it showed 7 bands under 254 nm and 366 nm. The comparative TLC studies showed the similarities between *Shadanga Paniya* and its ingredients.

Conclusion: The typical type of solvent system [Toluene: Ethyl acetate: Formic acid: Methanol (6:3:0.1:1)] is shows the proper separation in *Shadanga Paniya*. Therefore, the findings of the present study may be found helpful to standardise *Shadanga Paniya*.

Keywords: TLC, Chromatography, Ayurveda, *Shadanga Paniya*, COVID-19, Standardization, Quality control

1. Introduction

Ayurveda – the ancient science of life has its motto to preserve a healthy person's health and cure the diseased condition of a person. To get and maintain the healthy status of the body, one requires medicine of the purest quality. Ancient scriptures have mentioned formulations intended to maintain health and cure the disease [1].

Shadanga Paniya is a kind of independent *Yoga* (formulation). It is considered '*Bhaishaja Siddha Paniya Kalpana*' (Medicated water). The *Shadanga* word represents six (6) different ingredients. These ingredients take in equal quantity in the manufacturing process. The second word, *Paniya*, literary means liquid media or water as a medium. So, it has been revealed that *Shadanga Paniya* is a medicated water or medicated liquid [2]. It

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should be consumed at room temperature after filtration.

Shadanga Paniya is indicated in *Pippasayukta jwara* [3] (fever with thirst). It is also suggested in *Pittajwara* (fever due to vitiation of Pitta Dosha). *Shadanga Paniya* removes toxic substances from the blood. It also removes Pitta through sweating and the urination process [3]. The *Shadanga Paniya* is a drug of choice to treat coronavirus symptoms. *Shadanga Paniya* mentioned in the Guidelines for Ayurveda Practitioners for Covid-19 management [4].

Shadanga Paniya is a medicine prescribed by Ayurvedic physicians for a long time. However, the analytical data from the standardisation point of view is not found to date. In the present era, the demand for Ayurvedic medicines is high. This leads probability of manufacturing these medicines of substandard quality being high. This is equivalent to compromising the health of human beings.

The present study focused on the preparation of *Shadanga Paniya* by following the standard classical method. The analytical profile of *Shadanga Paniya* is carried out to develop a Quality Assessment and TLC profile. This work may be beneficial in the current Ayurvedic drugs standardisation need scenario.

1.1. Aims & objectives

- A) To prepare *Shadanga Paniya* as per the standard classical procedure
- B) To establish Quality Profile and TLC fingerprinting of *Shadanga Paniya*
 - 1) To carry out organoleptic tests of *Shadanga Paniya*
 - 2) To carry out Preliminary Phytochemical screening of *Shadanga Paniya*
 - 3) To carry out Physicochemical evaluation of *Shadanga Paniya*
 - 4) To design TLC fingerprinting of *Shadanga Paniya*
 - 5) To compare TLC fingerprinting of *Shadanga Paniya* with individual ingredients.

2. Materials & methods

The materials and methods section is divided into two parts; the first part is about the preparation of *Shadanga Paniya*. The second part deals with the primary aim to establish the standard for *Shadanga Paniya*.

2.1. Manufacturing process of *Shadanga Paniya* [3]

2.1.1. Collection of raw materials

Acharya Chakradutta has mentioned six different medicinal plants for formulating *Shadanga Paniya*. The ingredients were collected from a local market of Jamnagar. The department of *Dravyaguna* (ITRA-Pharmacy) authenticated the collected samples. Herbarium Specimens of the plants were preserved in the department. The voucher specimen numbers are 1132, 1140, 1144, 1148, 1151, and 1153 for *Nagarmotha*, *Pittapapada*, *Khasa*, *Lal Chandan*, *Sugandhabala* and *Sunthi*, respectively. The department has selected the ingredients as mentioned in the classical text. These selected six ingredients are listed below with their part used and botanical source.

2.1.2. Ingredients

Procedure: The procedure of manufacturing *Shadanga Paniya* is mentioned in the below chart. This manufacturing procedure is performed at the Department of *Rasa Shastra* (ITRA-Pharmacy), Jamnagar, following the classical method.

2.2. Quality evaluation of *Shadanga Paniya*

The analytical studies were carried out for quality evaluation of *Shadanga Paniya*. It includes findings of different tests, chemical screening, physicochemical parameters and TLC fingerprinting profile.

2.2.1. Sample selection criteria

The prepared sample of *Shadanga Paniya* was selected. There is a chance of raw material adulteration due to the high demand for Ayurvedic formulations. Here, in the present study, the market sample of premixed *Shadanga Paniya* was avoided to establish its basic Analytical Profile.

2.2.2. Selection of analytical methods

The mentioned tests and procedures are the keys to determining the quality and purity of prepared *Shadanga Paniya*. These materials and methods are selected as per the standard protocol provided by the Government of India. These tests are especially for ASU drugs to find out and establish standards.

Sr. No.	Name of Plant	Botanical Name	Family	Part used	Weight
1	<i>Nagarmotha</i>	<i>Cyperus scariosus</i> R. Br.	Cyperaceae	Root	1 Karsha (10 gm)
2	<i>Pittapapada</i>	<i>Fumaria parviflora</i> Lam.	Fumariaceae	Whole Plant	1 Karsha (10 gm)
3	<i>Khasa</i>	<i>Vetiveria zizanioides</i> (Linn.) Nash	Gramineae	Root	1 Karsha (10 gm)
4	<i>Lal Chandana</i>	<i>Pterocarpus santalinus</i> Linn. f.	Leguminosae	Wood	1 Karsha (10 gm)
5	<i>Sugandhabala</i>	<i>Pavonia odorata</i> Willd.	Malvaceae	Root	1 Karsha (10 gm)
6	<i>Sunthi</i>	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizome	1 Karsha (10 gm)
7	<i>Jala</i>	–	–	–	1 Prastha (1 lit)

The Government of India provided essential analytical methods for different dosage forms of ASU drugs. Among them, basic analytical tests are selected for preliminary study. The *Shadanga Paniya* is a kind of liquid dosage form. C.C.R.A.S. (Central Council for Research in Ayurvedic Sciences) guidelines provide different parameters for the primary establishment of quality [5].

1. Organoleptic tests of *Shadanga Paniya*

Determination of different organoleptic characteristics viz. colour, odour, taste and clarity of prepared *Shadanga Paniya* was carried out.

2. Preliminary Phytochemical screening of *Shadanga Paniya* [6–8]

A qualitative screening of *Shadanga Paniya* was performed. 25 ml *Shadanga Paniya* was taken into evaporating dish and evaporated to complete dryness. Now that dried residue was subjected for extraction with methanol (100 ml), keeping it overnight with initial occasional shaking up to 6 h and then set aside. After 24 h, it was filtered, and the alcoholic extract was collected. The extract was used for phytochemical screening.

3. Physicochemical evaluation of *Shadanga Paniya*

a. Total solid content [9]

The method was used to determine the solid concentrations in the preparation.

b. Specific gravity [10]

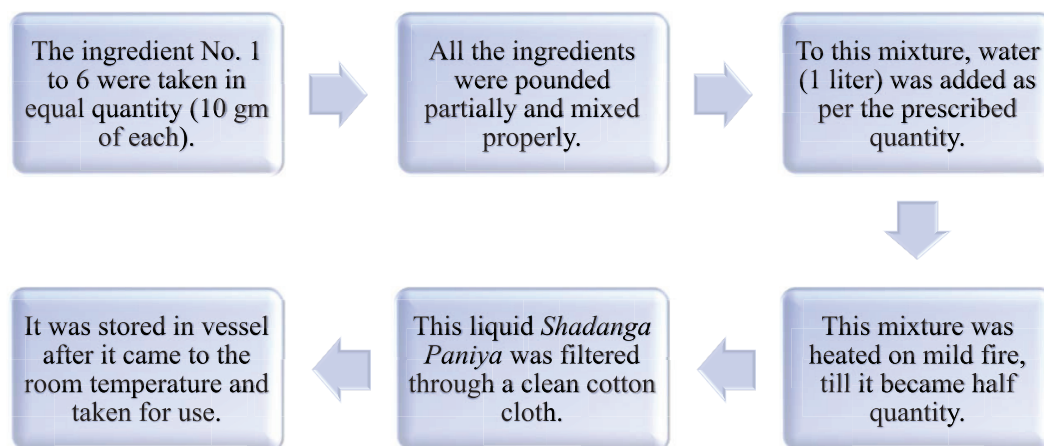
The specific gravity is the weight of a given volume of the liquid at 25° (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, all weighing being taken in air.

c. Refractive index [10]

The refractive index (η) of a substance with reference to air is the ratio of the sine of the angle of incidence to the sine of the angle of refraction of a beam of light passing from air into the substance. It varies with the wavelength of the light used in its measurement.

d. pH [11]

The pH value of an aqueous liquid may be defined as the common logarithm of the reciprocal of the hydrogen ion concentration expressed in g per lt. Although this definition provides a proper, practical means for the quantitative indication of the acidity or alkalinity of a solution, it is less satisfactory from a strictly theoretical point of view.



This prepared *Shadanga Paniya* was used to establish Standardization and TLC profile.

Table 1. Organoleptic characters of *Shadanga Paniya*.

Sr. no.	Parameter	Description
1	Colour	Reddish-brown
2	Odour	Characteristics
3	Taste	Astringent
4	Appearance	Clear liquid

4. TLC profile of *Shadanga Paniya* [11]

Thin-layer chromatography is a technique in which a solute undergoes distribution between two phases, stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry, finely powdered material applied to a glass, plastic or metal sheet or plate. Pre-coated plates are most commonly used. Separation may also be achieved based on a partition or a combination of partition and adsorption, depending on the particular type of support, its preparation and its use with a different solvent. Identification can be achieved by observing spots of identical R_f value (distance travelled by component/solvent run) and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size and intensity of the spots usually serves for semi-quantitative estimation.

This method is, at present, an essential analytical tool for qualitative and semi-quantitative analysis of several natural products. The adsorbent, such as Silica Gel G, is coated to a thickness at 0.3 mm or clean TLC plates using a commercial spreader; the plate is activated at 1050 °C for 30 min and used. The mobile phase selection depends upon the type of constituents to be analysed. After developing the chromatogram by ascending technique, the resolved spots are revealed by spraying with suitable detecting agents. TLC technique is an analytical tool for micro-analytical separation and determination of natural products.

TLC conditions:

Sample preparation: 25 ml *Shadanga Paniya* was taken into evaporating dish and evaporated to complete dryness. Now that dried residue is extracted with 5 ml of Methanol twice and combined. That combined methanolic extract is now used as a sample.

Stationary Phase: Merck pre-coated silica gel 60 F254 plate

Solvent system: Toluene: Ethyl acetate: Formic acid: Methanol (6:3:0.1:1)

Solvent front: 8.2 cm

Spray reagent: 10% Methanolic Sulphuric Acid

5. Comparison of the *Shadanga Paniya* TLC profile with the TLC profile of its ingredients [11]

The comparative TLC study was carried out by following standard protocol. The principles of comparative research are the same, mentioned in the TLC profile for *Shadanga Paniya*. *Shadanga Paniya* is compared here with its ingredients.

TLC conditions for comparison:

Sample preparation:

Shadanga Paniya was taken 25 ml into an evaporating dish and evaporated to complete dryness. Now that dried residue is extracted with 5 ml of methanol twice and combined. That combined methanolic extract was used as a sample.

All the other ingredients were taken in a quantity of 2.5 g separately. They all were extracted with 50 ml of methanol for 30 min. The methanolic solutions of components were filtered and concentrated to 5 ml. These solutions were used for spotting. This extracted samples of *Shadanga Paniya* and all the ingredients were labelled as mentioned below.

T1- Track 1: Methanolic extract of *Shadanga Paniya*.

T2- Track 2: Methanolic extract of *Nagarmotha*

T3- Track 3: Methanolic extract of *Pittapapda*

T4- Track 4: Methanolic extract of *Khasa*

T5- Track 5: Methanolic extract of *Lal Chandana*

T6- Track 6: Methanolic extract of *Sungdhabala*

T7- Track 7: Methanolic extract of *Sunthi*

Stationary Phase: Merck pre-coated silica gel 60 F254 plate

Solvent system: Toluene: Ethyl acetate: Formic acid: Methanol (6:3:0.1:1)

Solvent front: 8.2 cm

Spray reagent: 10% Methanolic Sulphuric Acid

3. Results

3.1. Organoleptic tests of *Shadanga Paniya*

The organoleptic tests result of *Shadanga Paniya* is mentioned in Table 1. The colour, odour, taste and appearance are reddish-brown, astringent, transparent liquid, respectively.

3.2. Preliminary phytochemical screening of *Shadanga Paniya*

The preliminary qualitative tests showed that Alkaloids, Tannin, Protein, Resin and Terpenoids were absent. While Flavonoid, Carbohydrate, Saponin, Phenol, and Glycoside were present in *Shadanga Paniya*. Details are mentioned in below Table 2.

Table 2. Results of preliminary phytochemical profiles of Shadanga Paniya.

Sr. No.	Phytochemical	Aqueous extract
1	Alkaloids	–
2	Tannin	–
3	Flavonoids	+
4	Carbohydrate	+
5	Saponin	+
6	Protein	–
7	Phenol	+
8	Glycoside	+
9	Resin	–
10	Terpenoids	–

3.3. Physicochemical evaluation of Shadanga Paniya

The physicochemical parameters were performed by considering essential parameters of *Shadanga Paniya* – liquid preparation. This includes Total solid content, Specific gravity, Refractive Index and pH. The findings of these parameters are shown in Table 3.

3.4. TLC fingerprinting of Shadanga Paniya

TLC fingerprinting was one of the fundamental objectives of the present study. Below are the photographs of *Shadanga Paniya* TLC. TLC shows the separation of components at a different level at different wavelengths and after spray [Fig. 1].

TLC showed 3 spots under 254 nm UV [Fig. 1a], 3 spots under 366 nm UV [Fig. 1b] and after spraying methanolic sulphuric acid solution (10%), 7 spots under 254 nm UV (after spray) [Fig. 1c] and 7 spots under 366 nm UV (after spray) [Fig. 1d]. R_f values of all spots and their colour are mentioned in Table 4.

3.5. TLC comparison of Shadanga Paniya with all the ingredients

An evaluation between the ingredients of *Shadanga Paniya* and formulation *Shadanga Paniya* – final dosage form, was carried out. This comparison was carried out with the help of a TLC technique. The observational data of comparison is presented in different figures.

Table 3. Results of Physicochemical evaluation of Shadanga Paniya.

Sr. No.	Parameters	Observed values
1	Total solid content	0.812% w/v
2	Specific gravity	1.0083
3	Refractive Index	1.334
4	pH	4.2

The observation was carried out by different visualisation. Methanolic extracts of the samples were subjected to separation. Detection of compounds was observed before applying spray reagent and after using spray reagent. It was marked with different wavelengths at daylight, short UV (254 nm) and long UV (366 nm).

3.5.1. Observation before applying spray reagent. The data before applying spray reagents is shown in Figures 2 and 3. The observation under short UV and long UV showed less compound separation in *Shadanga Paniya*. It also expressed that the drugs *Nagarmotha*, *Pittapapda*, *Khasa* and *Sugandhabala* have identical separation under short UV. The samples of *Lal Chandana* and *Sunthi* exhibited the highest compound separation under short UV [Fig. 2].

The long UV visualisation showed identical compound separation between *Nagarmotha*, *Khasa* and *Sugandhabala*. The observation under long UV revealed more separation in *Pittapapda*, *Lal Chandana* and *Sunthi* [Fig. 3].

The result of the TLC technique comparison before applying spray reagent is shown in Table 5 (A). The result showed only 02 spots of *Shadanga Paniya*, *Nagarmotha*, *Khasa* and *Sugandhabala* when observed under 254 nm wavelength. The result revealed identical R_f values between *Shadanga Paniya* and *Nagarmotha* at 254 nm. The data of 366 nm wavelength showed the R_f value 0.42 is found similar in *Shadanga Paniya*, *Pittapapda* and *Lal Chandana* [Table 5 (A)].

3.5.2. Observation after applying spray reagent. The TLC plate was also observed after applying the spray reagent. A 10% methanolic sulphuric acid is used as a spraying reagent. The proper separation of compounds was found after applying spray reagent. The separation was observed at short UV (254 nm), long UV (366 nm) and under daylight.

The result of separation is presented via images shown in Figs. 4–6. The *Shadanga Paniya* sample shows more amount of compound separation after spray. The sample of *Shadanga Paniya* was compared with its all ingredients. The result of observation under short UV revealed *Pittapapda*, *Khasa* and *Sugandhabala* have similar components. These components are also observed in *Shadanga Paniya*. The components in *Lal Chandana*, *Sunthi* and *Nagarmotha* are also found in *Shadanga Paniya* [Fig. 4].

The TLC plate observed under long UV provides more detailed information about the separation of components. It showed different colours of separated components. All the samples showed the

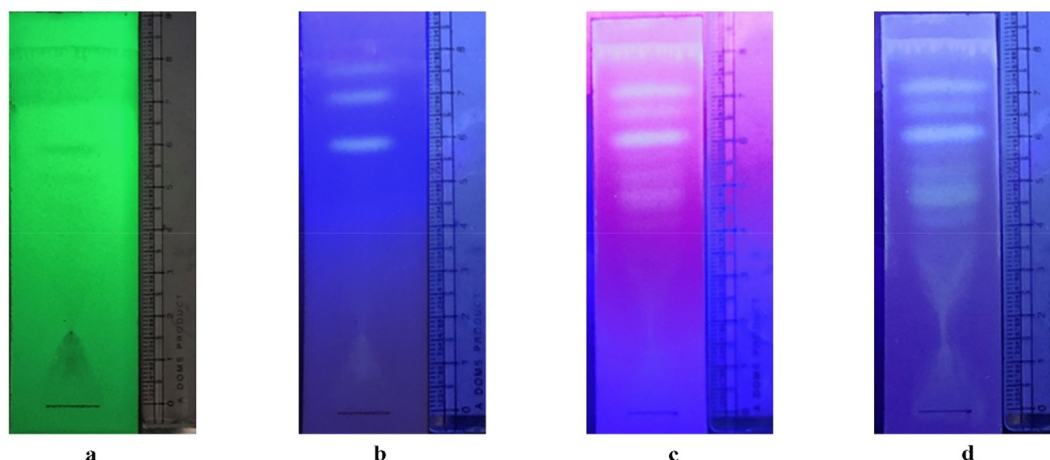


Fig. 1. Thin Layer chromatography of Shadanga Paniya. (a) Thin layer chromatography plate before spray at 366 nm. (c) Thin layer chromatography plate after spray at 254 nm. (d) Thin layer chromatography plate after spray at 366 nm.

highest compound separations under long UV (366 nm). This result revealed *Shadanga Paniya* has different colours of compound separation. These colours of components are also observed in *Nagarmotha*, *Pittapapda*, *Khasa*, *Lal Chandana*, *Sugandhabala* and *Sunthi* [Fig. 5].

The correlation of *Shadanga Paniya* with its substances shows many similarities. The similar R_f values can display these similarities. Under short UV (254 nm), the observation showed 07, 04, 07, 05, 10, 05, 09 spots for *Shadanga Paniya*, *Nagarmotha*, *Pittapapda*, *Khasa*, *Lal Chandana*, *Sugandhabala* and *Sunthi*, respectively. The observation under long UV (366 nm) showed 07, 06, 08, 08, 10, 07, 12 spots for *Shadanga Paniya*, *Nagarmotha*, *Pittapapda*, *Khasa*, *Lal Chandana*, *Sugandhabala* and *Sunthi*, respectively. Under short UV, the R_f value 0.31 is similar in *Shadanga Paniya* and *Nagarmotha*. The observed visualisation data under 254 nm showed R_f values 0.40 and 0.95 are identical in all samples. The other R_f values, 0.62, 0.64, 0.69, 0.76 of *Shadanga Paniya*, are similar to *Lal Chandana* and *Sunthi* [Table 5 (B)].

The R_f values observed under 366 nm exhibited components similarities. The R_f value 0.18 observed under 366 nm is similar in *Shadanga Paniya* and

Nagarmotha. The other R_f values, 0.40, 0.75, 0.81, are identical in all the samples. The *Shadanga Paniya*, *Khasa* and *Sunthi* showed an exact R_f value of 0.60. The R_f Value 0.64 is identical in *Shadanga Paniya*, *Lal Chandana* and *Sunthi*. The samples *Sugandhabala* and *Shadanga Paniya* have a similar R_f value of 0.68. All these data were observed under long UV 366 nm [Table 5 (B)].

All the tracks showed the clear component separation under daylight. This was not observed before spraying the reagent. Track 1, *Shadanga Paniya* illustrated that the different colours of components are similar to the other tracks components. Track 1 to track 7 has the same light yellowish-brown coloured element. Track 5, *Lal Chandana*, showed the highest number of different colour components separation. Track 3 *Pittapada* and track 2 *Nagarmotha* exhibited identical types of features [Fig. 6] right.

The result after spraying of reagent showed separation of substances under daylight clearly. It showed 06, 05, 07, 05, 10, 07, 09 spots in *Shadanga Paniya*, *Nagarmotha*, *Pittapapda*, *Khasa*, *Lal Chandana*, *Sugandhabala* and *Sunthi*, respectively. Amongst the different R_f values, the R_f value 0.41 is similar in all

Table 4. Results of general TLC fingerprinting of Shadanga Paniya.

UV 254 nm		UV 366 nm		UV 254 nm after spray		UV 366 nm after spray		
R_f value	R_f value	Colour of the band	R_f value	Colour of the band	R_f value	Colour of the band	R_f value	Colour of the band
0.54	0.71	Sky blue	0.51	Light Purple	0.50	Light Blue		
0.63	0.84	Sky blue	0.58	Light Purple	0.57	Yellowish Blue		
0.71	0.92	Light Blue	0.64	Pinkish Purple	0.63	Light Blue		
			0.69	Purple	0.69	Blue		
			0.74	Sky Blue	0.74	Sky Blue		
			0.81	Purplish Blue	0.81	Blue		
			0.87	Sky blue	0.87	Sky Blue		

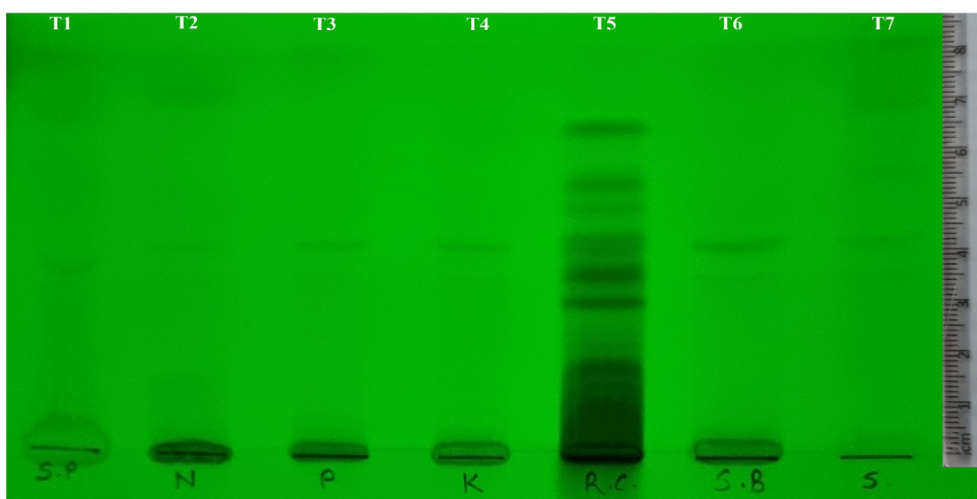


Fig. 2. TLC fingerprinting comparison of Shadanga Paniya with all the ingredients before spray visualization at 254 nm.

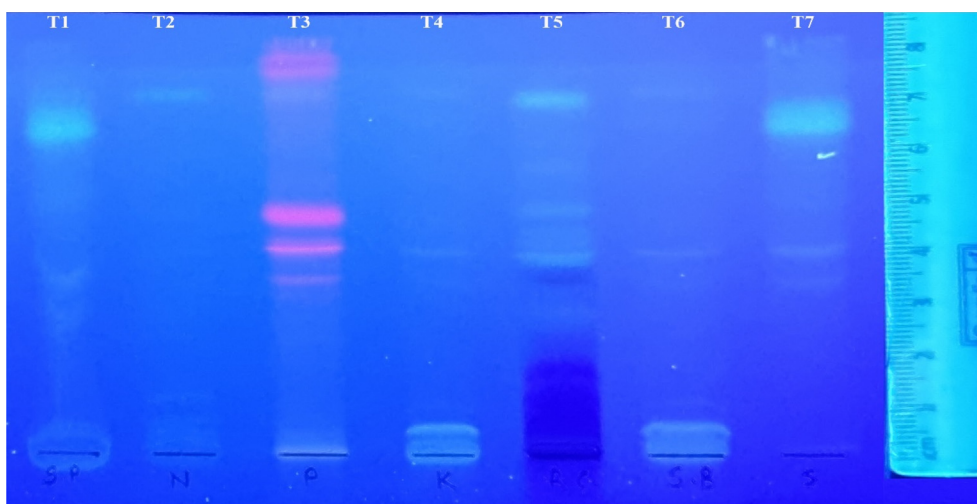


Fig. 3. TLC fingerprinting comparison of Shadanga Paniya with all the ingredients before spray visualization at 366 nm.

Table 5 (A). Results of TLC study comparison of Shadanga Paniya with all the ingredients.

Sr. No.	Sample Name	Before Spray			
		Visualisation			
		254 nm		366 nm	
		No. of spots	R _f Values	No. of spots	R _f Values
1	<i>Shadanga Paniya</i>	02	0.45, 0.81	03	0.34, 0.42, 0.78
2	<i>Nagarmotha</i>	02	0.45, 0.81	02	0.15, 0.85
3	<i>Pittapapda</i>	03	0.42, 0.48, 0.57	06	0.42, 0.48, 0.57, 0.85, 0.91, 0.95
4	<i>Khasa</i>	02	0.42, 0.48	02	0.48, 0.85
5	<i>Lal Chandana</i>	10	0.21, 0.25, 0.29, 0.36, 0.42 0.48, 0.51, 0.58, 0.64, 0.80	08	0.20, 0.28, 0.42 , 0.46 0.51, 0.56, 0.68, 0.84
6	<i>Sugandhabala</i>	02	0.41, 0.50	02	0.46, 0.84
7	<i>Sunthi</i>	04	0.43, 0.51, 0.68, 0.84	04	0.40, 0.47, 0.76 , 0.82

Bold indicates the formulation Shadanga Paniya have similar components.

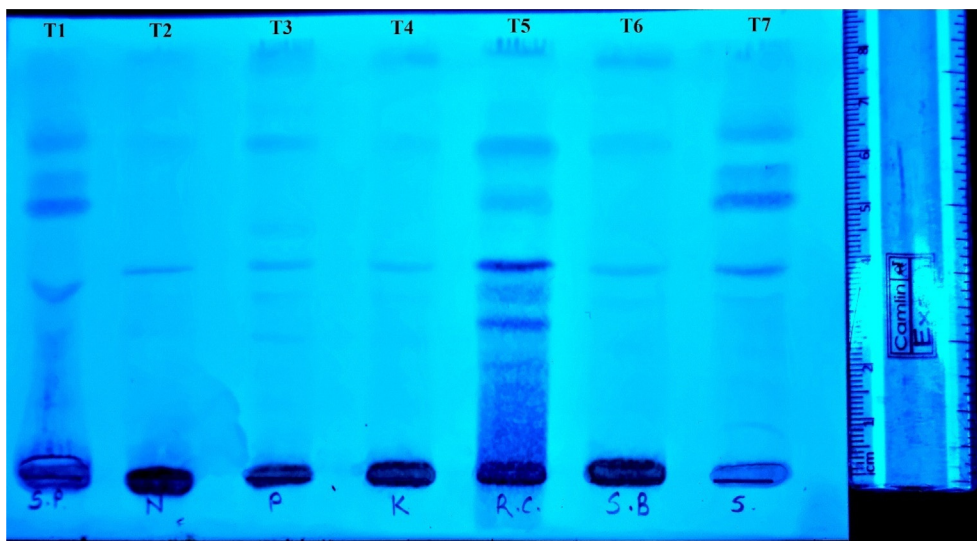


Fig. 4. TLC fingerprinting comparison of *Shadanga Paniya* with all the ingredients after spray visualization at 254 nm.

samples. The R_f Value 0.18 is similar in *Shadanga Paniya* and *Sugandhabala*. The samples of *Shadanga Paniya*, *Lal Chandana* and *Sunthi* showed an equal R_f value of 0.62. The R_f values 0.68 & 0.78 of *Shadanga Paniya* are similar to *Pittapapda*, *Khasa* and *Sunthi* [Table 5 (C)].

4. Discussion

Key findings of the present study revealed that *Shadanga Paniya* is a compound Ayurvedic formulation that can be termed as medicated water. The pharmaceutical batch size of the preparation was 1 L. It took, on average, 50 min to prepare the final product. Quality evaluation of *Shadanga Paniya* was carried out, including organoleptic characteristics,

preliminary phytochemical study, physicochemical evaluation and TLC fingerprinting. The comparative TLC study was also carried out between *Shadanga Paniya* and its components. It was an attempt to check the quality parameters of *Shadanga Paniya* as no such research has been found performed on this particular composition to date.

4.1. Strength of the study

A solvent system for TLC fingerprinting of *Shadanga Paniya* was developed in this study. Provided solvent system observes the proper separation of components (Fig. 1 and Table 1). This separation of components reveals that the solvent system

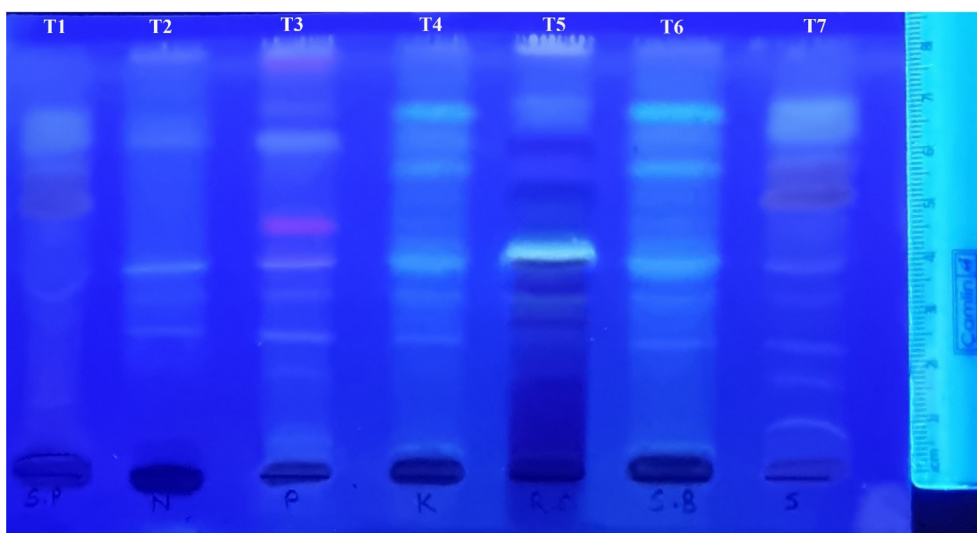


Fig. 5. TLC fingerprinting comparison of *Shadanga Paniya* with all the ingredients after spray visualization at 366 nm.

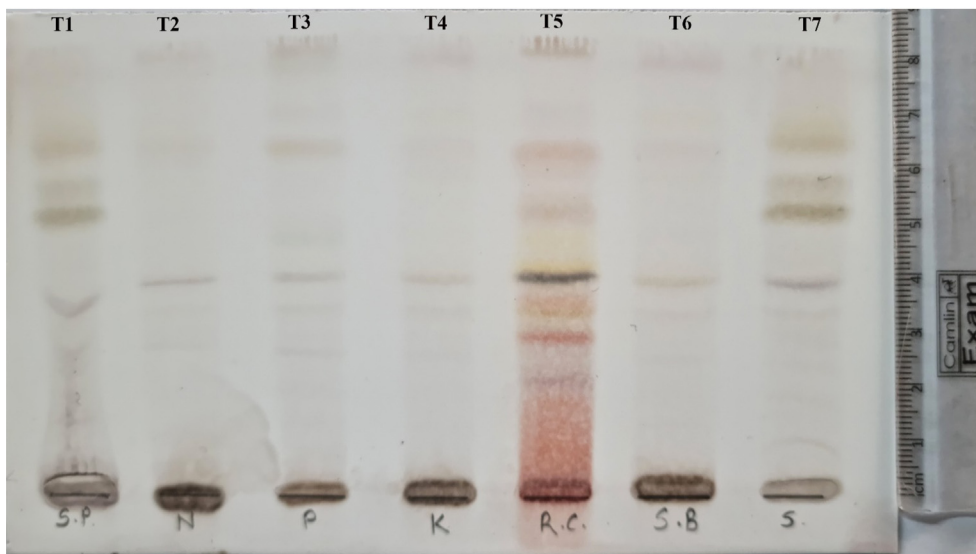


Fig. 6. TLC fingerprinting comparison of Shadanga Paniya with all the ingredients after spray visualization under day light.

Table 5 (B). Results of TLC study comparison of Shadanga Paniya with all the ingredients.

Sr. No.	Sample Name	After Spray			
		Visualisation			
		254 nm		366 nm	
		No. of spots	R _f Values	No. of spots	R _f Values
1	<i>Shadanga Paniya</i>	07	0.31, 0.40, 0.62, 0.64, 0.69, 0.76, 0.95	07	0.18, 0.40, 0.60, 0.64, 0.68, 0.75, 0.81
2	<i>Nagarmotha</i>	04	0.31, 0.46, 0.74, 0.95	06	0.23, 0.30, 0.40, 0.46, 0.75, 0.93
3	<i>Pittapapda</i>	07	0.30, 0.40, 0.46, 0.54, 0.74, 0.82, 0.95	08	0.23, 0.30, 0.40, 0.46, 0.54, 0.75, 0.81, 0.93
4	<i>Khasa</i>	05	0.35, 0.40, 0.46, 0.75, 0.95	08	0.29, 0.34, 0.46, 0.56, 0.60, 0.67, 0.74, 0.81
5	<i>Lal Chandana</i>	10	0.24, 0.29, 0.34, 0.40, 0.46, 0.62, 0.70, 0.76, 0.82, 0.96	10	0.29, 0.34, 0.39, 0.41, 0.46, 0.50, 0.64, 0.73, 0.81, 0.95
6	<i>Sugandhabala</i>	05	0.29, 0.40, 0.46, 0.78, 0.95	07	0.28, 0.40, 0.46, 0.68, 0.76, 0.81, 0.96
7	<i>Sunthi</i>	09	0.10, 0.19, 0.26, 0.40, 0.46, 0.64, 0.69, 0.78, 0.82	12	0.10, 0.18, 0.26, 0.40, 0.46, 0.60, 0.64, 0.67, 0.68, 0.75, 0.79, 0.81

Bold indicates the formulation Shadanga Paniya have similar components.

Table 5 (C). Results of TLC study comparison of Shadanga Paniya with all the ingredients.

Sr. No.	Sample Name	After Spray Visualization under daylight	
		No. of spots	R _f Values
1	<i>Shadanga Paniya</i>	06	0.18, 0.32, 0.41, 0.62, 0.68, 0.78
2	<i>Nagarmotha</i>	05	0.31, 0.41, 0.47, 0.76, 0.96
3	<i>Pittapapda</i>	07	0.31, 0.41, 0.48, 0.57, 0.78, 0.86, 0.96
4	<i>Khasa</i>	05	0.30, 0.41, 0.48, 0.78, 0.96
5	<i>Lal Chandana</i>	10	0.24, 0.35, 0.40, 0.41, 0.48, 0.49, 0.62, 0.75, 0.86, 0.97
6	<i>Sugandhabala</i>	07	0.18, 0.30, 0.41, 0.46, 0.75, 0.85, 0.95
7	<i>Sunthi</i>	09	0.10, 0.21, 0.28, 0.41, 0.47, 0.62, 0.68, 0.78, 0.81

Bold indicates the formulation Shadanga Paniya have similar components.

[Toluene: Ethyl acetate: Formic acid: Methanol (6:3:0.1:1)] can be used for further identification. This

may be found helpful to identify substandard quality drugs.

The comparative TLC study exhibits the presence of identical chemical components in *Shadanga Paniya* and its ingredients. Therefore, TLC study results lead to understanding the solvent system [Figs. 2–6 & Table 5(A) to Table 5(C)]. This may be helpful to understand the chemical nature of all the samples. In the panic of COVID-19, the chances of releasing adulterated drugs in the market are high. Therefore, this study may show its significance in tracing such practices.

4.2. Limitations of the study

The study was limited to quality aspects of the product. Further in-depth research is to be done to determine the safety and efficacy of this particular composition.

4.3. Future research suggested

As far as analytical data, the present study has identified the majority of specifications and values. However, further research should be done regarding the quantitative evaluation of Flavonoid, Carbohydrate, Saponin, Phenol and Glycoside contents. In addition, pre-clinical and clinical studies should also be attempted to scientific data of *Shadanga Paniya*.

5. Conclusion

The organoleptic characters of *Shadanga Paniya* fulfilled the standards of Ayurvedic preparation. Preliminary phytochemical screening revealed the presence of flavonoids, carbohydrates, saponin, phenols and glycoside. Due to the importance of quality assessment and standardisation, physico-chemical evaluation was performed to set the standard. TLC fingerprinting was developed in which it was found that Methanolic extract of *Shadanga Paniya* showed separation. The solvent system for the TLC was Toluene: Ethyl acetate: Formic acid: Methanol (6:3:0.1:1). This system was found to be the choice to run proper chromatography. 10% Methanolic Sulphuric acid was used as a spray reagent. The comparative TLC study showed identical components between *Shadanga Paniya* and its ingredients. Thus, TLC can be considered an essential tool for the quality control measures of *Shadanga Paniya*. TLC will help to establish the identity, degree of purity and quality of the *Shadanga Paniya* and act as quality assurance standards. It will increase the acceptance of *Shadanga Paniya* without compromising human health in the present scenario.

Credit author statement

Mehul D. Mehta: Concepts, Design, Definition of intellectual content, Experimental studies, Data acquisition, Data analysis, Manuscript review. **Kunal M. Gohil:** Concepts, Design, Literature search, Experimental studies, Manuscript preparation, Manuscript review. **Krunal A. Doshi:** Concepts, Design, Literature search, Manuscript preparation, Manuscript editing, Manuscript review.

Conflict of interest

None.

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