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Preliminary Quality Assessment of Selected Indian Medicinal Plants For Their Application in Pharmaceutical Industry

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Abstract

Indian subcontinent is a one of the richest sources of herbal collection and possesses an estimation of near 6000-7000 medicinal floras which contributes towards the economic development of the country. The herbal drugs are of eco-friendly nature, economical, safer and register better tolerance in patients still some eminent issues such as availability of sub-standard herbs limit the acceptance of different formulations in the society. Hence, the government laws and stringent rules along with education of the personnel involved are helping in the improvement of this scenario. Taking such issues in consideration, this study has been designed to evaluate the quality standards of selected medicinal herbs, of which *Arka, Punarnava, Rasna* and *Mahanimb/ Saurabhanimba* were sourced from the Ayushya Vatika of Lovely Professional University, Punjab, while *Star anise, Aswagandha, Amla, Beheda* and *Haritaki* were procured from the local market, Jalandhar. The standard pharmacognostical protocol was followed for macroscopic, microscopic, preliminary phytochemical screening and purity analysis for the collected samples and compared with the standards as available in API. The final results presented the crude herbs to be of good quality, possessing assessed components as suggested by API. This study clearly depicts that some of these medicinal herbs may be cultivated in this region of Indian subcontinent for supplying high quality of these raw materials for large scale use in the manufacturing industry.

Key words: Arka, Punarnava, Rasna, Mahanimb, Star anise, Aswagandha, Amla, Baheda, Haritaki , Herbal Drug, Standardisation, Phytochemical screening

Introduction

India is the land which presents the use of herbs as food, medicines and preservatives since ages. The application of numerous plants has been documented in classical texts such as Charaka Samhita, Sushruta Samhita and Bhaavprakash in different ailments [1]. With the modernization globally, the chemicals such as analgesics and antibiotics lead the treatment scenario resulting in the emergence issues such as arthritis and antibiotic resistant bacterial strains. A global alarm has been generated and a focus has been made to reinstitute the use of

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natural drugs in the daily life of the population [2]. There has been marked increase in the use of herbal drugs in the last decade by health industries. This is observed by the fact that there has been nine fold increase of export value of medicinal plants in India to nearly Rs 3,211 crores in 2014-2015 [3]. The medicinal plants has their contribution not only towards herbal industry but forms an integral part of heath care system for Indian population and are the source of living hood to many [3]. The herbal drugs are of eco-friendly nature, economical, safer and register better tolerance in patients [4].

Table 1: Botanical source and reported phytochemicals in Ayurvedic Pharmacopoeia of India [5]

Medicinal Herb	**Botanical Source**			**Reported Phytochemicals in API**
	Botanical Name	**Family**	**Part use**	
Arka	*Calotropis procera*	Asclepidiaceae	Leaf, stem	Glycoside (Calotropin)
Punaranava	*Boerhavia diffusa*	Nyctaginaceae	Leaf, stem, roots	Alkaloid (Punarnavine)
Nirgundi	*Vitex negundo*	Verbenaceae	Leaf	Negundoside, Agnuside
Rasna	*Pluchea lanceolata*	Compositae	Leaf	Flavonoids (uercetin, Isorhamnetin)
Saurabhanimba	*Murray koenigii*	Rutaceae	Leaf	Alkaloids (koenigine, koenidine, koembine, mahanimbine, murrayacine, muconine), volatile oils
Star Anise	*Illicium verum*	Asteraceae	Fruit	Plant not mentioned
Amla	*Emblica officinalis*	Euphorbiaceae	Fruit	Gallotanins, Ascorbic acid
Baheda	*Terminalia bellirica*	Combreteaceae	Fruit	Gallic acid, Glycosides, Tannic acid
Haritaki	*Terminalia chebula*	Combreteaceae	Fruit	Tannins, Anthraquinines, Polyphenolic compounds
Ashwagandha	*Withania somnifera*	Solanaceae	Root	Alkaloids, Withanolides
Ajmoda	*Apium graveolens*	Apiaceae	Fruit	Essential oils, Fixed oils

Indian subcontinent possesses an estimation of near 6000-7000 medicinal floras [3]. This medicinal wealth contributes towards the economic progress of the country. These medicinal herbs play a significant role in maintaining the rural and the urban health in the form of medicines, cosmetics and Neutraceuticals. Multi-potential pharmacological nature of many herbs qualifies them to be used in variety of formulations with different use. Amongst the hundreds of medicinal herbs, selected parts of eleven herbs including *Punarnava, Arka, Nirgundi, Rasna, Mahanimb, Amalaki, Baheda, Haritaki, Ajmoda, Star anise* and *Aswagandha* were studied for their preliminary quality standards.

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Materials and Methods

The fresh plant samples including stem of *Punarnava*, leaves of *Arka, Nirgundi, Rasna and Mahanimb* were collected from the Ayushya Vatika, Lovely professional University, in the month of June, 2019 at 10.15 am in the morning. The collected samples were washed properly to remove the soil and other contaminants such as grass. Thereafter, the samples were shade dried/ in sunlight for 4 days up to complete dryness. The dried fruits of *Amalaki, Baheda, Haritaki, Ajmoda* and *Star anise* along with roots of *Aswagandha* were procured from the local market of Jalandhar, Punjab. The dried samples were powdered in the mixer grinder and stored in a sterilised plastic container at room temperature for further use. All the chemicals used were of analytical grade and purchased from Loba chemicals, Mumbai, India. All the glassware used was of borosilicate.

Dried samples were subjected to macroscopic and microscopic analysis. The features of the samples were determined and replicated on the paper.

Preparation of the extract

Each 2.5 g of the powdered drug was dissolved in 50 ml of ethanol and double distilled water separately in 100 ml plugged conical flask followed by continuous stirring for 6 h over a magnetic stirrer. Thereafter, the crude extraction was done by keeping the flasks still at room temperature for next 42 h. Subsequently, it was filtered and filtrate was used for the further study. For short term preservation, the extracts were kept in the refrigerator at 4°C [6, 7].

Physico-chemical analysis of selected herb samples

The powder of the selected medicinal herbs were subjected to analysis for foreign matter, loss on drying (LOD), total ash, acid insoluble ash, water soluble ash alcohol soluble extractive along with water soluble extractive. The determined values were then compared with the suggested values from standards text, Ayurvedic Pharmacopoeia of India (API), for their quality assessment. The standard protocols were followed for the analysis [6, 7].

Preliminary qualitative phytochemical analysis of selected herb samples

Subsequently, the obtained extracts were subjected to different tests to ensure the presence of phytochemicals of variable classes. The standard protocols were followed for the analysis [6, 8].

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Results and Discussion

Medicinal herbs have always been an integral contributor to alleviate diseases along with applications in the food industry. Nowadays, due to multiple issues arising with the synthetic drugs such as antibiotic resistance, medicinal herbs are being considered as one of the solutions, as determined by the extent of contemporary researches involving plant origin drugs. The reliability of different formulations involving crude herbals involves availability and use of high and good quality medicinal herbs. In order to ensure the use of high performing herbals in pharmaceutical industry, different check parameters have been suggested by the standard authorities, which must be complied upon. Amongst those checks, the macroscopic and microscopic identification along with identity, purity and strength helps in understanding the quality of supplied raw matter of the herbals [9].

The selected parts of the herbal drugs (Figure 1) were subjected to macroscopic and microscopic examination and thereafter its comparative analysis with reference to the standard description as available in API has been done. The determined characters of the crude drug samples were similar to the features as available in API, suggesting the samples to be appropriate. Adulteration of authentic herbals with similar looking herbs, dissimilar or toxic substances is a major concern to the herbal manufacturing industry as such practices may often lead to poorly performing products or sometimes even toxicity in patients consuming such medicines [10]. Hence, while procuring crude samples, manufacturer must ensure the availability of correct raw herbal sample.

Figure 1: Images of selected medicinal plants used in the study

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Figure 2: Drying of the freshly collected herbs

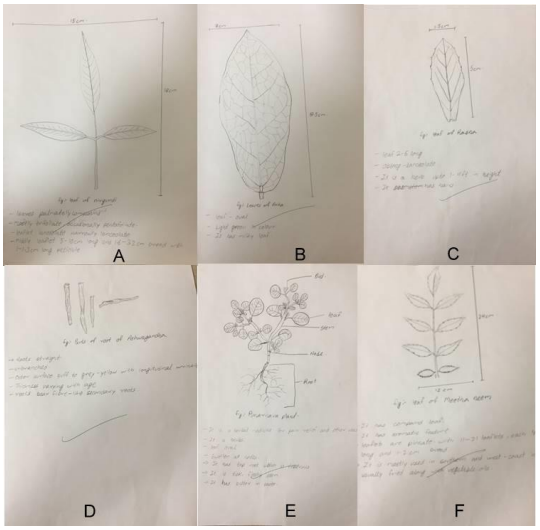

Figure 3: Macroscopic determination of parts of some selected herbs under study; A: Nirgundi leaf; B: Arka leaf; C: Rasna leaf; D: Aswagandha root; E: Punarnava whole plant; F: Mahanimb leaf

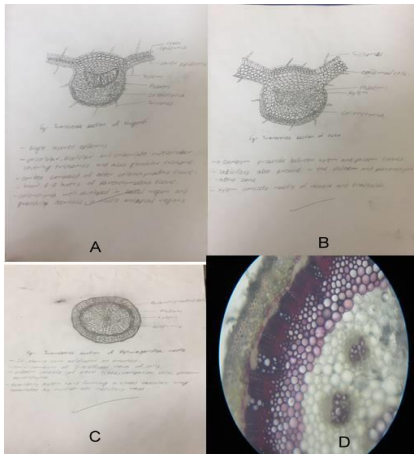

Figure 3: Microscopic determination of parts of some selected herbs under study; A: Nirgundi leaf; B: Arka leaf; C: Aswagandha root; D: Punarnava stem

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Physico-chemical analysis of selected herb samples

Physicochemical analysis is a crucial parameter to determine the quality standards of the procured raw drugs. Collection of plant matter generally involves the inclusion of other unwanted contaminants in a small quantity. The procured raw matter must possess only the part of plant required for the purpose and must be exclusive of substances such as sand, pebbles, moulds, fungi, insects, other parts of same or different plants, excreta along with chemical residues. Hence, macroscopic examination along with determining the extent of foreign matter must be ensured [5, 9]. All the herbal samples included in this study determined foreign matter within the suggested limits.

The presence of moisture in the raw herbal drugs helps the microbial contamination of the raw matter by supporting the growth of microbes such as bacteria, fungi and moulds which subsequently degrade the active constituents present in the plant matter [10]. Proper drying of the collected raw drugs maintains the potential constituents for longer duration enabling the better efficiency of the sourced plant matter. The LOD values have been presented in the table. It was found within limits for *Nirgundi* leaves [11], while standard values for other plants under study are not available.

Once the raw matter is incinerated completely, the left over is ash which is mainly composed of inorganic material. On subjecting this ash to acid, the insoluble matter thus obtained is mainly constituted by acid insoluble ash which is composed of substances such as silicates, carbonates and phosphates and it helps in determining the extent of soil present in the crude drug sample [9, 10]. The eleven crude drugs under study possessed the total ash and acid insoluble ash within the suggested limits (Table 2).

Herbal drugs are a house of multiple phytochemicals which are responsible for their pharmacological potentials. These active constituents possess variable chemical structures which affect their solubility in solvents with different polarities. Hence, determining the extraction of crude drug samples with alcohol and water helps in understanding the amount of constituents present and acknowledging the adulteration of the procured herbal samples [9, 10]. The eleven crude drugs under study possessed the ethanolic and aqueous extractive values within the suggested limits (Table 2) [5].

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Figure 4: Ash determination of selected herbal drugs

Table 2: Physico-chemical analysis of selected herb samples

Parameter	Foreign matter (%)		Loss on drying (%)		Total ash (%)		Acid-insoluble ash (%)		Alcohol-soluble extractive (%)		Water-soluble extractive (%)	
Medicinal Herb												
	API	**DV**	**API**	**DV**	**API**	**DV**	**API**	**DV**	**API**	**DV**	**API**	**DV**
Arka	<2	0.91	NM	13.06	<21	20	<5	3.87	>5	8.70	>24	31.8
Punarnava	<2	0.82	NM	18	<15	14.86	<6	4.34	>1	1.82	>4	8
Nirgundi	<2	1	<12	10	<8	2	<1	0.6	>10	11	>20	28
Rasna	<2	1.2	NM	13	< 22	18	<7	5.2	>8	9.04	>23	28.25
Mahanimb	<2	0.82	NM	9.83	<12	5.81	<2	3.26	>20	27.4	>34	42.6
Star Anise	NM	0	NM	0.42	NM	4.65	NM	2.1	NM	18.9	NM	20.2
Amla	<3	0.9	NM	0.82	<7%	5.82	<2	1.6	>40	42.3	>50	50.69
Baheda	<2	Nil	NM	6.5	<7	5.97	<1	1	>8	13.27	>35	42.04
Haritaki	<1	Nil	NM	6.12	<5	3.68	<5	2.45	>40	48.9	>50	52.7
Aswagandha	<2	1	NM	3.8	<7	6.20	<1	0.2	>15	18.75	NA	NA
Ajmoda	<5	3.86	NM	2	<14	8.70	<14	6	>14	19.23	>3	6.92

- API: Ayurvedic Pharmacopoeia of India; DV: Determined Value; NM: Not mentioned; NA: Not Applicable
- Nil: Not Determined
- Comparison with suggested limits as in API has been presented in the table

Figure 3: Extractive determination of selected herbal drugs

Preliminary qualitative phytochemical analysis of selected herb samples

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In order to characterise the different classes of phytoconstituents, phytochemical screening of the obtained extracts is usually conducted. It enables to understand the presence of phytochemicals in the herbal drug and correspondingly, the purity of the procured samples [10]. Carbohydrates, alkaloids and tannins were present in the ethanolic extracts of all the sample drugs (Table 3). Saponins were determined only in the aqueous extracts of all samples (Table 4). The qualitative phytochemical screening, as conducted in this study, helped in revealing the secondary metabolites present in selected herbal samples.

Table 3: Preliminary qualitative phytochemical analysis of selected herb samples

Phytochemical Detected	Test	*Arka*	*Punarnava*	*Nirgundi*	*Rasna*	*Mahanimb*	*Star Anise*	*Amla*	*Baheda*	*Haritaki*	*Aswagandha*	*Ajmoda*
Carbohydrate	Benedict's test	+	+	+	+	+	+	+	+	+	+	+
Steroid	Salkowski reaction	—	—	—	—	+	—	+	+	—	—	+
	Liebermann-Bouchard reaction	+	+	+	—	—	—	—	+	+	+	+
Glycoside	Modified Borntrager's test for c-glycosides	+	+	—	+	+	+	—	—	+	—	—
Saponin glycosides	Foam test	—	—	—	—	—	—	—	—	—	—	—
Alkaloids	Dragendorff's test	+	+	+	+	+	+	+	+	+	+	+
	Mayer's test	+	+	+	+	+	+	+	+	+	+	+
	Hager's test	+	+	+	—	—	+	—	+	+	+	+
	Wagner's test	+	+	+	+	+	+	—	—	—	+	—
Tannins	5%$FeCl_3$ solution	+	+	+	+	+	+	+	+	+	+	+
	Acetic acid solution	—	+	+	—	+	—	+	+	+	—	+
	Iodine solution	+	—	—	+	—	+	+	—	+	+	+
	Dilute HNO_3	—	+	—	—	+	+	—	—	—	—	+

+: Present; - : Absent; Analysis of ethanolic extracts have been determined

Table 4: Preliminary qualitative phytochemical analysis of selected herb samples

Phytochemical Detected	Test	*Arka*	*Punarnava*	*Nirgundi*	*Rasna*	*Mahanimb*	*Star Anise*	*Amla*	*Baheda*	*Haritaki*	*Aswagandha*	*Ajmoda*
Carbohydrate	Benedict's test	+	+	+	+	+	+	+	+	+	+	+
Steroid	Salkowski reaction	—	—	—	—	+	—	+	+	—	—	+
	Liebermann-Bouchard reaction	+	+	+	—	—	—	—	+	+	+	+
Glycoside	Modified Borntrager's test for c-glycosides	+	+	—	+	+	+	—	—	+	—	—
Saponin glycosides	Foam test	+	+	+	+	+	+	+	+	+	+	+

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Alkaloids	**Dragendorff's test**	+	+	+	+	+	+	+	+	+	+	+
	Mayer's test	+	+	+	+	+	+	+	+	+	+	+
	Hager's test	+	+	+	—	—	+	—	+	+	+	+
	Wagner's test	+	+	+	+	+	+	—	—	—	+	—
Tannins	**5%$FeCl_3$ solution**	+	+	+	+	+	+	+	+	+	+	+
	Acetic acid solution	—	+	+	—	+	—	+	+	+	—	+
	Iodine solution	+	—	—	+	—	+	+	—	+	+	+
	Dilute HNO_3	—	+	—	—	+	+	—	—	—	—	+
+: Present; — : Absent; Analysis of aqueous extracts have been determined												

Conclusion

Herbs drugs form an integral part of the human life in the form of medicinal agents. Availability of high quality, standardised drugs is of a high concern with the herbal industry nowadays that affects the efficacy of the formed products. This study was focussed to analyse the quality of some selected herbs which were either collected from the Ayushya Vatika or purchased from the market. The selected herbal samples were found to be of standardised quality as per the parameters suggested by API. The presence of different phytochemicals is suggestive of the chemical constituents extracted by the solvent used. Hence, these drugs may be used in formulating different forms of medicines such as oils, syrups or powders along with different combinations to contribute towards the healing of different human ailments.

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