Studies on Quality Evaluation of Some Commercial Herbal Drugs and Spices

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Abstract

Commercial samples of ten herbal drugs and spices of fruit and seed origin viz. *Capsicum frutescens* L., *Coriandrum sativum* L., *Cuminum cyminum* L., *Emblica officinalis* Gaertn., *Foeniculum vulgare* Mill., *Piper longum* L., *Piper nigrum* L., *Syzygium cumini* L. (Skeels.), *Terminalia chebula* Retz. and *Trigonella foenum-graecum* L. were evaluated to assess their quality in respect of identity, purity and strength. The samples were resourced from Delhi, Hardwar and Ghaziabad markets. Evaluation is based on specific parameters and limits developed by standardising authentic samples of drugs and spices.

Key-words: Pharmacognostic evaluations, commercial herbal drugs, quality assessment.

Introduction

Herbal drugs are also used as an ingredient of health supplements, spices, natural dyes, perfumery, cosmetics, toiletries etc. The herbal drug also leads to potential synthetic drugs. *Commiphora mukul* **Engl.** (hypolipidaemic), *Centella asiatica* (L.) Urb. (nootropic), *Boswellia serrata* Triana & Planch. (anti-inflammatory), *Trichopus zeylanicus* Gaerten (adaptogen); *Withania somnifera* Dunal. (anti stress), *Pterocarpus marsupium* Roxb. (diabetes mellitus), *Albizia lebbeck* (L.) Benth. (bronchial asthma), *Trigonella foenum-graecum* (diabetes mellitus) are some of the potential medicinal plants species with proven pharmacological studies. The commercial demand of herbal drugs to fetch the need of different sectors is growing at a very fast pace. There is a global awareness for the use of herbal products. But in India, the supply of raw material has not kept pace with the increasing global demand for herbal drugs. Indian herbal market is endowed with vast range of medicinal plants and these plants have made a good contribution to the development of herbal based industries.

Herbal drugs used by the industries are collected from the wild resources. It is estimated that about 800 species are used in production by the pharmaceutical industry, whereas less than 40 species of plants are resourced through commercial cultivation. Over 70% of the plant collection involves destructive harvesting. This poses a definite threat to the genetic stocks and to the diversity of medicinal plants. Adulterants/substitutes are being traded/ used with at times with full knowledge of the sellers/buyers and are very common in the herb trade especially when the trade is involved. Herbs sold

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in powdered forms, eg:- the powders of *Pterocarpus santalinum* (Red Sandal or Lal Chandan) are much more prone to adulteration. The use of some species as substitute of a medicinal plant comes in the picture when the originally recommended plant gets rare and its price rises. In many cases, substitutes have taken over the original plants. In some cases, substitutes have become popular, manufacturers have forgotten about the original plant and they only use substitutes available in the market. It is very much doubtful if such substitution is made after testing or as recommended by any authority. Sometimes different morphological parts of same plant species is used in place of prescribed part. Use of stem bark in place of roots are not uncommon. At times mere look alike species are used as a substitute, which may not even contain the active ingredients available through the main plants nor the effects of the end product is the same as that obtained from that of original plant (Sharma, 1987; Rai *et al*., 2011 and Padmakumar *et al*., 2012).

Materials and Methods

The fruit and seed herbal drugs under study were collected from natural habitats and authenticated with references to pharmacopoeial standards and other literature. The commercial samples sold under the trade names purported to be prescribed species were drawn from the different market sources (Delhi, Hardwar and Ghaziabad). Standard protocols/methods prescribed in pharmacopoeia were followed for pharmacognostical, physico-chemical and phytochemical parameters prescribed in Ayurvedic, Unani and Siddha Pharmacopoeia of India. Standards limits in respect of each parameter were obtained by conducting these tests on pre-authenticated material of these drugs (Anonymous, 1986, 1998, 1999, 2007a, b, & 2008).

Table 1: Commercial Herbal Drugs under study

S. No.	Botanical name	Trade name	Morphological part	Utility patterns
1.	Capsicum frutescens L.	Lal mirch	Fruit	Drug and Spice
2.	Coriandrum sativum L.	Dhaniya	Fruit	Drug and Spice
3.	Cuminum cyminum L.	Jeera	Fruit	Drug and Spice
4.	Emblica officinalis Gaertn.	Awala	Fruit	Drug
5.	Foeniculum vulgare Mill.	Sauf	Fruit	Drug and Spice
6.	Piper longum L.	Pipali	Fruit	Drug and Spice
7.	Piper nigrum L.	Kali mirch	Fruit	Drug and Spice
8.	Syzygium cumini (L.) Skeels.	Jamun	Seed	Drug

S. No.	Botanical name	Trade name	Morphological part	Utility patterns
9.	Terminalia chebula Retz.	Harad	Fruit pericarp	Drug
10.	Trigonella foenum-graecum L.	Methi	Seed	Drug and Spice

Observations and Results

All the commercial samples of the drugs collected from Delhi, Haridwar and Ghaziabad were evaluated as per the parameters of quality specifications viz. pharmacognostical characteristics (Identification), histo-chemical tests, major organic groups of chemical compounds (phytoconstituents), physico-chemical constants, UV-Spectrophotometric study and HPTLC fingerprinting prescribed in various Pharmacopoeias and other literature for herbal drugs. (Table 2 to 11). The qualitative and quantitative values in respect of quality specification were predetermined on authenticated herbal drugs comparable with pharmacopoeial standards (Rai, 2012).

Table 2. Quality Evaluation of Commercial Drug Samples of *Capsicum frutescens* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	+	+	+	+
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	+	+	+	+
	Steroid	+	+	+	+
	Tannin	–	–	–	–

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	0.7	0.5	1.0
	Moisture content, % w/w, Not more than	6.0	5.0	6.7	7.0
	pH	7.2	7.1	7.0	6.9
	Total Ash, % w/w , Not more than	14.5	13.0	13.6	14.2
	Acid insoluble ash, % w/w, Not more than	2.5	2.1	2.4	2.3
	Alcohol soluble extractive % w/w, Not less than	15.6	15.8	16.6	16.2
	Water soluble extractive % w/w, Not less than	33.0	31.0	35.0	32.0
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	2 absorption peaks	2 absorption peaks	2 absorption peaks	2 absorption peaks
F	HPTLC Fingerprinting after derivatization	5 spots	5 spots	4 spots	6spots

Table 3. Quality Evaluation of Commercial Drug Samples of *Coriandrum sativum* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	–	–	–	–
	Anthraquinone	+	+	+	+

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	+	+	+	+
	Steroid	+	+	+	+
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	2.3	1.7	0.5
	Moisture content, % w/w, Not more than	10.0	8.0	12.2	9.6
	pH	7.3	7.1	7.1	7.0
	Total Ash, % w/w , Not more than	2.5	3.0	2.2	2.1
	Acid insoluble ash, % w/w, Not more than	2.0	2.5	2.2	2.2
	Alcohol soluble extractive % w/w, Not less than	10.0	12.0	12.6	11.7
	Water soluble extractive % w/w, Not less than	20.0	18.9	21.4	21.6
	Essential Oil , % v/w, Not less than	0.25	0.10	0.12	0.10
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	6 spots	5 spots	6 spots	6 spots

Table 4. Quality Evaluation of Commercial Drug Samples of *Cuminum cyminum* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	–	–	–	–
	Anthraquinone	–	–	–	–
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	+	+	+	+
	Resin	–	–	–	–
	Saponin	–	–	–	–
	Steroid	–	–	–	–
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	2.2	1.9	1.7
	Moisture content, % w/w, Not more than	8.0	9.0	7.5	7.9
	pH	7.3	7.2	6.9	7.3
	Total Ash, % w/w , Not more than	7.5	8.0	7.2	6.9
	Acid insoluble ash, % w/w, Not more than	1.0	1.3	0.9	1.2
	Alcohol soluble extractive % w/w, Not less than	6.5	5.0	4.6	6.2
	Water soluble extractive % w/w, Not less than	13.0	12.1	13.6	13.9
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	9 spots	9 spots	9 spots	9 spots

Table 5. Quality Evaluation of Commercial Drug Samples of *Emblica officinalis* Gaertn.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	–	–	–	–
	Coumarin	–	–	–	–
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	–	–	–	–
	Resin	–	–	–	–
	Saponin	–	–	–	–
	Steroid	–	–	–	–
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	1.0	1.2	1.6
	Moisture content, % w/w, Not more than	10.0	9.7	9.6	11.0
	pH	6.4	6.5	6.8	6.9
	Total Ash, % w/w, Not more than	6.5	5.0	6.2	6.4
	Acid insoluble ash, % w/w, Not more than	2.0	1.7	1.9	2.1
	Alcohol soluble extractive % w/w, Not less than	3.0	3.6	4.0	3.2
	Water soluble extractive % w/w, Not less than	45.0	41.2	36.0	38.7
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	2spots	2 spots	2 spots	2 spots

Table 6. Quality Evaluation of Commercial Drug Samples of *Foeniculum vulgare* Mill.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	+	+	+	+
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	+	+	+	+
	Steroid	+	+	+	+
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	1.7	2.1	1.5
	Moisture content, % w/w, Not more than	11.0	9.2	8.6	10.3
	pH	7.2	7.0	7.1	7.1
	Total Ash, % w/w , Not more than	12.5	10.7	11.1	9.0
	Acid insoluble ash, % w/w, Not more than	15.5	12.2	10.7	6.4
	Alcohol soluble extractive % w/w, Not less than	3.0	3.6	3.2	3.9
	Water soluble extractive % w/w, Not less than	00.5	00.6	0.8	1.1
	Essential Oil , % v/w, Not less than	1.0	0.7	0.6	0.9
E	UV-Spectrophotometric study	4 absorption peaks	4 absorption peaks	4 absorption peaks	4 absorption peaks
F	HPTLC Fingerprinting after derivatization	4 spots	4 spots	4 spots	4 spots

Table 7. Quality Evaluation of Commercial Drug Samples of *Piper longum* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	–	–	–	–
	Coumarin	+	+	+	+
	Flavonoid	–	–	–	–
	Glycoside	–	–	–	–
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	–	–	–	–
	Steroid	–	–	–	–
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	0.5	0.7	0.6
	Moisture content, % w/w, Not more than	11.0	12.2	9.7	7.2
	pH	6.9	7.0	7.1	7.0
	Total Ash, % w/w , Not more than	5.0	5.1	4.9	3.7
	Acid insoluble ash, % w/w, Not more than	0.50	0.46	0.51	0.48
	Alcohol soluble extractive % w/w, Not less than	10.5	12.2	10.9	11.4
	Water soluble extractive % w/w, Not less than	23.50	24.7	25.0	27.2
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	6 spots	6 spots	6 spots	6 spots

Table 8. Quality Evaluation of Commercial Drug Samples of *Piper nigrum* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	+	+	+	+
	Coumarin	+	+	+	+
	Flavonoid	–	–	–	–
	Glycoside	–	–	–	–
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	–	–	–	–
	Steroid	–	–	–	–
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	2.3	1.7	1.8
	Moisture content, % w/w, Not more than	6.0	6.3	5.0	4.2
	pH	6.7	6.9	6.6	7.1
	Total Ash, % w/w , Not more than	5.5	3.2	4.7	4.9
	Acid insoluble ash, % w/w, Not more than	0.5	0.2	0.7	0.6
	Alcohol soluble extractive % w/w, Not less than	6.0	5.7	6.9	7.2
	Water soluble extractive % w/w, Not less than	6.0	.2	5.7	7.7
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	2 absorption peaks	2 absorption peaks	2 absorption peaks	2 absorption peaks
F	HPTLC Fingerprinting after derivatization	5 spots	5 spots	5 spots	5 spots

Table 9. Quality Evaluation of Commercial Drug Samples of *Syzygium cumini* (L.) Skeels.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	–	–	–	–
	Anthraquinone	+	+	+	+
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	+	+	+	+
	Resin	+	+	+	+
	Saponin	+	+	+	+
	Steroid	–	–	–	–
	Tannin	–	–	–	–
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	0.5	1.0	0.9
	Moisture content, % w/w, Not more than	15.0	13.6	12.2	10.0
	pH	7.1	7.0	7.1	7.1
	Total Ash, % w/w , Not more than	5.0	4.8	4.6	5.2
	Acid insoluble ash, % w/w, Not more than	1.0	0.9	0.6	1.1
	Alcohol soluble extractive % w/w, Not less than	5.0	6.2	6.6	6.1
	Water soluble extractive % w/w, Not less than	12.0	13.3	14.4	15.7
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	4 spots	4 spots	4 spots	4 spots

Table 10. Quality Evaluation of Commercial Drug Samples of *Terminalia chebula* Retz.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	–	–	–	–
	Anthraquinone	–	–	–	–
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	–	–	–	–
	Resin	+	+	+	+
	Saponin	–	–	–	–
	Steroid	–	–	–	–
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	1.1	0.9	1.3
	Moisture content, % w/w, Not more than	12.0	11.6	9.2	10.7
	pH	7.2	7.0	6.9	7.2
	Total Ash, % w/w , Not more than	5.0	4.9	4.7	5.1
	Acid insoluble ash, % w/w, Not more than	1.0	0.7	0.9	0.9
	Alcohol soluble extractive % w/w, Not less than	5.0	6.7	5.9	6.2
	Water soluble extractive % w/w, Not less than	12.0	14.0	13.2	15.0
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	3 absorption peaks	3 absorption peaks	3 absorption peaks	3 absorption peaks
F	HPTLC Fingerprinting after derivatization	6 spots	6 spots	6 spots	6 spots

Table 11. Quality Evaluation of Commercial Drug Samples of Trigonella *foenum-graecum* L.

Sl. No.	Quality Specifications	Standard Limits	Samples drawn from the market of		
			Delhi	Haridwar	Ghaziabad
A.	Pharmacognostical Characteristics (Identification)				
	• Organoleptic	Descriptive	Conform	Conform	Conform
	• Micro-morphological	Descriptive	Conform	Conform	Conform
B.	Histo-chemical Tests	Descriptive	Conform	Conform	Conform
C.	Major organic groups of chemical compounds (Phyto-constituents)				
	Alkaloid	+	+	+	+
	Anthraquinone	–	–	–	–
	Coumarin	+	+	+	+
	Flavonoid	+	+	+	+
	Glycoside	+	+	+	+
	Protein	–	–	–	–
	Resin	–	–	–	–
	Saponin	+	+	+	+
	Steroid	+	+	+	+
	Tannin	+	+	+	+
D.	Physico-Chemical constants				
	Foreign Matter, %, w/w	2.0	2.7	2.2	1.7
	Moisture content, % w/w, Not more than	10.0	6.2	8.1	7.2
	pH	7.3	7.1	7.1	7.3
	Total Ash, % w/w , Not more than	6.5	5.0	6.9	6.3
	Acid insoluble ash, % w/w, Not more than	0.6	0.2	0.6	0.3
	Alcohol soluble extractive % w/w, Not less than	6.0	7.2	8.2	6.7
	Water soluble extractive % w/w, Not less than	30.0	34.3	29.7	32.0
	Essential Oil , % v/w, Not less than	–	–	–	–
E	UV-Spectrophotometric study	4 absorption peaks	4 absorption peaks	4 absorption peaks	4 absorption peaks
F	HPTLC Fingerprinting after derivatization	6 spots	6 spots	6 spots	6 spots

Table 12. Commercial Samples of Herbal Drugs and Spices not Conforming the Quality Specifications

S. No.	Quality Specifications	Commercial drug samples from Delhi (D), Haridwar (H) and Ghaziabad (G)									
		Cf	Cs	Cc	Eo	Fv	Pl	Pn	Sc	Tc	Tf
A.	Pharmacognostical Characteristics (Identification)										
	Organoleptic	-	-	-	-	-	-	-	-	-	-
	Micro-morphological	-	-	-	-	-	-	-	-	-	-
B.	Histo-chemical Tests	-	-	-	-	-	-	-	-	-	-
C.	Major organic groups of chemical compounds (Phyto-constituents)										
	Alkaloid	-	-	-	-	-	-	-	-	-	-
	Anthraquinone	-	-	-	-	-	-	-	-	-	-
	Coumarin	-	-	-	-	-	-	-	-	-	-
	Flavonoid	-	-	-	-	-	-	-	-	-	-
	Glycoside	-	-	-	-	-	-	-	-	-	-
	Protein	-	-	-	-	-	-	-	-	-	-
	Resin	-	-	-	-	-	-	-	-	-	-
	Saponin	-	-	-	-	-	-	-	-	-	-
	Steroid	-	-	-	-	-	-	-	-	-	-
	Tannin	-	-	-	-	-	-	-	-	-	-
D.	Physico-Chemical constants										
	Foreign Matter, %, w/w	-	D	D	-	H	-	D	-	-	D
	Moisture content, % w/w, Not more than	H, G	H	D	G	-	D	D	-	-	-
	pH	-	-	-	-	-	-	-	-	-	-
	Total Ash, % w/w , Not more than	-	D	D	-	-	D	-	G	G	-
	Acid insoluble ash, % w/w, Not more than	-	D, H, G	D, G	G	-	H	-	G	-	-
	Alcohol soluble extractive % w/w, Not less than	-	-	-	H	-	-	D	-	-	-
	Water soluble extractive % w/w, Not less than	D, G	D	H, G	-	-	-	H	-	-	H
	Essential Oil , % v/w, Not less than	-	D, H, G	-	-	D, H, G	-	-	-	-	-
E.	UV-Spectrophotometric study	-	-	-	-	-	-	-	-	-	-
F.	HPTLC Fingerprinting after derivatization	G	D	-	-	-	-	-	-	-	-

Abbreviations: Cf: *Capsicum frutescens* L., Cs: *Coriandrum sativum* L., Cc: *Cuminum cyminum* L., Eo: *Emblica officinalis* Gaertn., Fv: *Foeniculum vulgare* Mill., Pl: *Piper longum* L., Pn: *Piper nigrum* L., Sc: *Syzygium cumini* L. (Skeels.), Tc: *Terminalia chebula* Retz. and Tf: *Trigonella foenum-graecum* L.

Discussion and Conclusion

Pharmaco-botanical evaluation of commercial samples of herbal drugs with comparison to genuine and authenticated crude drug samples reveal the extent of authenticity and quality of commercial samples. Each drug is discussed in the table 12. All the commercial samples do not conform the requirement of physico-chemical constants. Physico-chemical constants (foreign matter, moisture content, pH, total Ash, acid insoluble ash, alcohol soluble, water soluble, and essential oil) reveal the status of samples in respect of purity (physical contamination) and strength (extractive values, indicating the availability of phyto-constituents in a drug).

The present study reveals that commercial samples are always subject to quality control for their authenticity to ensure identity, purity and strength as per pharmacopoeial and other quality standards before their use to formulate the medicine. This quality evaluation practice may also ensure the safety and efficacy of medicine up to larger extent. Although all the herbal drugs are common in use but the analytical values in respect of quality parameters varies. The cause of non-conformance to identity is not to use genuine and prescribed plant species whereas difference in physico-chemical and phyto-chemical parameters leads to conclusion poor harvesting and storage practices adopted in commercial stock of drugs by collectors and traders. The code of 'Good Collection and Storage Practices' must be followed to ensure the availability of quality drug material in commerce.

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