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Der Pharmacia Lettre, 2014, 6 (2):178-183  
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## Formulation and comparative evaluation of different *Sitopaladi* herbal syrups

Devesh Tewari\* and Manoj Kumar

Smt. Tarawati Institute of Biomedical and Allied Sciences Roorkee Haridwar, Uttarakhand, India

### ABSTRACT

*Sitopaladi churna* is a polyherbal Ayurvedic medicine used for its antitussive activity from an ancient time. An attempt was made to develop a formulation to ease the administration of the phytoconstituents responsible for the activity. The *sitopaladi* churnas of two reputed companies of Ayurvedic medicines were taken and the syrup was made and evaluated. The present study is a primary stage to develop such a formulation which can improve the patient compliance as well as cost effectiveness. Various formulations were formulated and the comparative evaluation of the formulations was carried out to short out the best formulation. All the prepared formulation was evaluated for various parameters such as pH, viscosity, density, Organoleptic properties and stability studies. The development of such formulation will mark an important advancement in area of phytopharmaceuticals.

**Key words:** Sitopaladi churna, Patient compliance, syrup, phytopharmaceuticals

### INTRODUCTION

In the long struggle to overcome the powerful forces of nature, the human beings have always turned towards plants for food, shelter, clothing and healing. It is recognized that in developing countries like India, plants are the main medicinal source to treat infectious diseases [1]. The World Health Organization has estimated that 80% of the earth and 6 million inhabitants rely only upon traditional medicines for their primary health care needs and major part of the therapy involves the use of plant extracts or their active principles. Scientists in many parts of the world have carried out extensive research and have proven to humanity, the effective use of herbal medicine [2].

Cough is a defensive reflex of the respiratory tract which is important to clear the upper airways and should not be suppressed indiscriminately. Cough is thought to be caused by a reflex. It occurs due to stimulation of mechano or chemoreceptor in throat, respiratory passage or stretch receptor in the lungs. The sensitive receptors are located in the bronchial tree, particularly in the junction of the trachea. These receptors can be stimulated mechanically or chemically e.g. by inhalation of various irritants than nerve impulses activate the cough center in the brain. Non-narcotic antitussive agents anesthetize the stretch receptor located in respiratory passages, lungs and pleura by dampening their activity and thereby reducing the cough reflex at its source. Narcotic antitussive agents depress the cough center that is located in the medulla, thereby raising its threshold for incoming cough [3].

Sitopaladi churna is a polyherbal Ayurvedic medicine which contains; Sitopala (candy sugar), Vamsalochana (Silicious substance from *Bambusa arudinaceae*), Pippaliphala (*Piper longum*), Ela (*Elettaria cardamomum*), and Twak (*Cinnamomum zylenticum*) [4] and used as remedy for cold, cough, congestion, bronchitis, trachytis, sinus headache, respiratory allergy, seasonal sneezing, wheezing and excess mucous [5].

Sitopaladi churna is generally taken with honey possibly for the synergistic effect and it is in great demand for prevention of cough in children and elderly people and the administration of the medicament is sometimes leads to the non patient compliance. An attempt was made to develop syrup of sitopaladi which will produce more patient compliance and cost effectiveness. The formulation was a combined approach of traditional system of medicine with modern pharmaceuticals.

### MATERIALS AND METHODS

**Sitopaladi Churna:** The sitopaladi churnas of two reputed companies of Ayurvedic formulations i.e. Dabour and Divya Pharmacy were purchased from local pharmacy and swadeshi store from Haridwar.

**Instruments:** Pestle motar, glassrod, pH meter (Elico, model no. 212), density bottle, Ostwald viscometer, ultraviolet spectrometer (Elico double beam SL-210) etc.

**Preparation of Sitopaladi extract:** Each powder of sitopaladi was extracted separately using four liter of hydroalcoholic mixture (1:1) using cold maceration process. After seven days of maceration the extract was filtered out and concentrated below 40°C. The residue obtained was kept in a dessicator for further studies.

#### Preparation of the herbal syrup:

**Preparations of simple syrup:** The simple syrup (66.67% w/v) was prepared as per Indian pharmacopoeia. 66.7 gm of sucrose was weighed and added to purified water (1000ml) and heated until it dissolved with occasional stirring [6].

**Preparation of sitopaladi syrup:** Six different formulations (formulation code : Db A, Db A1, Dp B, Dp B1, FC, FD) of sitopaladi syrup was prepared by two different methods. Formulation Db A, Db A1, DpB, Dp B1 were prepared by sitopaladi churna in powder form in different amount and FC and FD were prepared by sitopaladi churna extract.

**Preparation of formulation Db A and Db A1:-** 10 gm and 5 gm powder of sitopaladi churna (Dabur) was weighed respectively and dissolved in 50 ml of previously prepared simple syrup

**Preparation of formulation Dp B and Dp B1:-** 10 gm and 5 gm powder of sitopaladi churna (Divya Pharmacy) was weighed and dissolved in 50 ml of previously prepared simple syrup.

**Method of preparation of formulation FC and FD:-** One part of decoction was mixed with five parts of simple syrup (1:5).

#### Method of preparation of decoction:-

Sitopaladi churna of both the companies (50 gm) was taken. Powder was mixed with 400 ml of water. The powder material was boiled until total volume become one forth of previous. After boiling the mixture was cooled and filtered. Filtrate was taken to prepare the final herbal syrup [7].

**Organoleptic evaluation** The organoleptic characters of the samples were evaluated based on the method described earlier [8]. Organoleptic evaluation refers to evaluation of the formulation by colour, odour, taste and texture etc.

**Angle of repose:** Angle of repose has been used as an indirect method quantifying powder flow ability, because of its relationship with interparticle cohesion. The fixed funnel and the free standing cone method employs a method that is secured with its tip at a given height (H), above the glass paper that is placed on a flat horizontal surface. Powder or granules were carefully poured through the funnel until the apex of the conical pile just touch the tip of funnel. Thus, with R being the radius of the conical pile. Angle of repose was calculated using the formula  $\tan \theta = h/r$ . Where h is the height of the heap of powder r is the radius of the base of the heap powder and  $\theta$  is the angle of repose.

**Estimation of density:** Density can be determined by the help of density bottle (25ml). The density bottle (25ml capacity) was taken and weight of empty bottle was noted. The liquid whose density will be determined is filled in

bottle and weighed. Then both the weight of syrup is calculated by subtract the weight of empty bottle from the filled bottle. Then the density of syrup is calculated by using the formula: Density=mass/volume

#### Estimation of spectra by ultraviolet spectroscopy

The wavelength of UV and visible light are substantially shorter than the wavelength of infrared radiation. A UV-Visible spectrophotometer measures the amount of light absorbed at each wavelength of the UV and visible regions of the electromagnetic spectrum. A UV or visible spectrophotometer has the same basic design as an infrared spectrophotometer. In a standard UV-Vis spectrophotometer, a beam of light is split; one half of the beam (the sample beam) is directed through a transparent cell containing a solution of the compound being analyzed, and one half (the reference beam) is directed through an identical cell that does not contain the compound but contains the solvent<sup>9</sup>. The spectra of the formulation code FC and FD were found out using simple syrup as reference.

#### Determination of viscosity

The viscosity of each formulation was determined by using the Ostwald's U-tube Viscometer.

#### Stability testing of sitopaladi herbal syrups

Stability study of prepared syrup was carried out for 60 days. The syrup was kept at different temperature and relative humidity for short term stability study at 40°C, 47°C and at room temperature. Humidity was maintained at 75% RH. The parameters such as turbidity, colour, microbial growth and taste were studied for stability. Syrup was stored in ambered colour glass bottle.

### RESULTS AND DISCUSSION

**Formulation of Sitopaladi Syrups:** The primary objective of the study was to develop various sitopaladi syrups as there is a problem of patient non compliance due to inconvenient method of administration, lot of wastage of the active ingredient and the formulation is expensive due to the vehicle i.e. generally honey or milk. The present study is a primary stage to develop such a formulation which can improve the patient compliance as well as cost effectiveness. Various formulations were formulated and the comparative evaluation of the formulations was carried out to short out the best formulation.

#### Organoleptic Evaluation

Visual inspection provides the simplest and quickest means by which to establish identity, purity and possibly quality in terms of colour, odour and taste. The organoleptic characters of the samples were carried out based on the method described earlier [8]. The organoleptic parameters were studied for about two months time period shown in Table no.1.1-1.9.

Table 1.1: Organoleptic properties of different Sitopaladi syrup formulation in the day of formulation

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Liquid	Dark brown	Sweet	Pleasant	Stable
Db A1	Liquid	Dark brown	Sweet	Pleasant	Stable
Dp B	Liquid	Dark brown	Sweet	Pleasant	Stable
Db B1	Liquid	Dark brown	Sweet	Pleasant	Stable
FC	Clear liquid	Light brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light brown	Sweet	Pleasant	Stable

Table 1.2: Organoleptic properties of different Sitopaladi syrup formulation after one week

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark brown	Sweet	Pleasant	Stable
Db A1	Turbid liquid	Dark brown	Sweet	Pleasant	Stable
Dp B	Turbid liquid	Dark brown	Sweet	Pleasant	Stable
Db B1	Turbid liquid	Dark brown	Sweet	Pleasant	Stable
FC	Clear liquid	Light brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light brown	Sweet	Pleasant	Stable

Table 1.3: Organoleptic properties of different Sitopaladi syrup formulation after two week

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	Unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	Unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	Unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	Unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

Table 1.4: Organoleptic properties of different Sitopaladi syrup formulation after three weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	LightBrown	Sweet	Pleasant	Stable
FD	Clear liquid	LightBrown	Sweet	Pleasant	stable

Table 1.5: Organoleptic properties of different Sitopaladi syrup formulation after four weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

Table 1.6: Organoleptic properties of different Sitopaladi syrup formulation after five weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

Table 1.7: Organoleptic properties of different Sitopaladi syrup formulation after six weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

Table 1.8 :Organoleptic properties of different Sitopaladi syrup formulation after seven weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B1	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

Table 1.9: Organoleptic properties of different Sitopaladi syrup formulation after eight weeks

Formulation code	Appearance	Colour	Taste	Odour	Stability
Db A	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db A <sub>1</sub>	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Dp B	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
Db B <sub>1</sub>	Turbid liquid	Dark Brown	Sour sweet	Rancid	unstable
FC	Clear liquid	Light Brown	Sweet	Pleasant	Stable
FD	Clear liquid	Light Brown	Sweet	Pleasant	stable

**Angle of repose**

The angle of repose is the angle between the surface of the pile and the ground under it. This test method is used for the determination of angle of repose of free flowing powders. The reports of angle of repose and density of both churnas are given in table. 2.

Table 2 Physical evaluation of different marketed products

S.No.	Brand name of the product	Angle of repose $\theta = \tan^{-1}(h/r)$	Flow property	Density
1	Dabur	27.47	Excellent	0.650
2	Divya Pharmacy	21.08	Excellent	0.575

**Determination of pH**

The pH of all the formulation was determined by the pH meter and the result in table. 3.

**Determination of viscosity**

The viscosity of the different sitopaladi syrup was determined using Ostwald viscometer and the results are given in table. 3.

**Ultraviolet Spectroscopy**

The  $\lambda_{max}$  was determined by the UV-visible spectrophotometer, of the two main formulation (FC, FD) and the result is given in the given table. 3.

Table.3 pH, viscosity and wavelength estimation of formulated sitopaladi syrup

S.No.	Formulation code	pH	Viscosity	Wavelength
1	DbA	6.4	1.4	-
2	DbA <sub>1</sub>	6.4	1.6	-
3	DpB	6.3	1.4	-
4	DpB <sub>1</sub>	6.4	1.6	-
5	FC	6.2	0.97	276.5 395.5 319
6	FD	6.2	0.98	358 395.5 320

As part of standardization procedure, the finished product Sitopaladi syrup was examined for relevant physical and chemical parameters. All the samples were whitish brown in colour. The powders were smooth, having fragrant odour, and sweet taste. The development of such formulation will mark an important advancement in area of phytopharmaceuticals. The 6 different formulation were prepared from Dabur & Divya pharmacy churna (n=3).

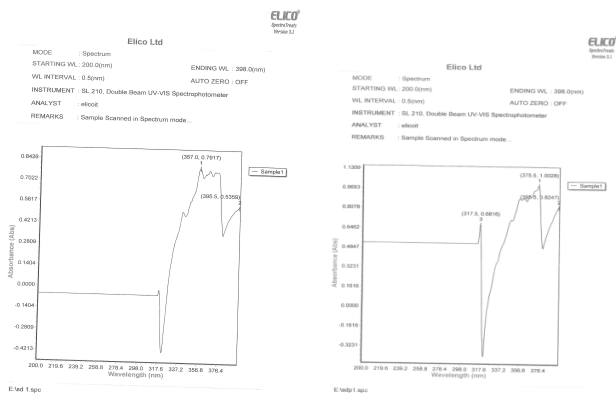


Figure 1 UV Spectra of the formulation FC and FD

All the prepared formulations were evaluated for various parameters such as pH, viscosity, density, organoleptic properties and stability studies, only two formulation FC and FD were passed all the parameter in comparison to other formulation and from the both formulation FC and FD, FC is more stable and it could be concluded that FC is the best formulation in all six formulations. Further studies are suggested to evaluate the antitussive properties of the formulation.

### CONCLUSION

Ayurveda is 'an ancient science of life' and incorporation of advance pharmaceuticals can serve in the betterment of the society the formulations obtained by these methods can be cost effective and leads to develop cheaper formulations. Further studies are required to validate various Ayurvedic formulations and the mechanism involved in the treatment of cough by sitopaladi.

### Acknowledgement

Authors are grateful to Dr Pankaj Sharma Director and Management of Smt. Tarawati Institute of Biomedical and allied Sciences Roorkee for providing necessary facilities and support.

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