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Research Article

Shonitasthapana Varga Dravya – Phytochemical Screening-Based Pharmacological Analysis

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I N F O

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A B S T R A C T

Introduction: The *Dashemani vargas* mentioned by *Charaka* and *Vagbhata* are based on the various karmas acquired by the drugs within the group. The *Shonitasthapana varga* includes *Madhu*, *Madhuka*, *Kunkuma, Mocharasa, Mritkapala, Gairika, Lodhra, Priyangu, Sharkara*, and *Laja*. Commentaries on the varga indicate the range of *karmas* like *Raktavardana, Raktaprasadhana/ raktsamshodana* and *Raktasthambana*. Phytochemical analysis of the *dravyas* will give a better cognisance of the pharmacological activities of the drugs and their therapeutic uses.

Objectives: To conduct phytochemical screening and pharmacological analysis of *shonitasthapana varga dravyas* based on their phytoconstituents

Method: A preliminary qualitative phytochemical screening was conducted on the drugs of *shonitasthapana varga* like *Madhuka, Mocharasa, Kunkuma, Lodhra*, and *Priyangu* to ascertain the presence of phytoconstituents and physicochemical analysis was conducted on *madhu, mritkapala, gairika, Sharkara,* and *laja*.

Results: The analysis revealed the presence of secondary metabolites like tannins, carbohydrates, proteins, flavonoids, terpenoids, steroids and phenols in *madhu, madhuka, Mocharasa, lodhra, Kunkuma,* and *priyangu*. Physicochemical analysis revealed iron, calcium, magnesium and other trace elements in *Mritkapala* and *laja*, whereas iron was present in gairika. Protein was present in all the drugs except *Mritkapala* and *gairika*.

Conclusion: Based on the analysis of the chemical constituents, it can be inferred that the *shonitasthapana varga dravyas* exhibit varied pharmacological activities, such as *raktavardhana, raktaprasadana*, or *raktasthambana*, depending on the individual drugs used within the group.

Keywords: Phytochemistry, *Shonithasthapana*, Pharmacology, *Rakta*, Blood

Introduction

Dravya forms one of the *Chikitsa Chatushpada* i.e., pillars of treatment and constitutes the most important component in the treatment of diseases.[1] The *dravya* may either be in the form of *Aushada* (medicine) or *Ahara* (food) which is responsible for the sustenance of health or in curing diseases. The effect of a *dravya* on the body can be attributed to its *karma*/ action on *dosha, dhatu, mala, agni, srotas ashaya*, etc. *Charaka* and *Vriddha Vagbhata* have classified the *dravyas* based on *karma* and mentioned ten drugs under each *karma*. *Shonitasthapana varga* is one such group consisting of dravyas like *Madhu, Madhuka, Kunkuma, Mocharasa, Mritkapala, Gairika, Lodhra, Priyangu, Sharkara* and *Laja*.[2]

This group constitutes drugs of *Ahara dravyas (Madhu, Sharkara, Laja*) and *Aushada dravyas* (*Madhuka, Kunkuma, Mocharasa, Mritkapala, Gairika, Lodhra and Priyangu)*. The drugs mentioned in the group have been indicated in conditions like *Raktapitta, Raktavikaras, daha, Visha, Vrana* etc.[3]

Generally, *Shonitasthapana varga dravyas* are understood as the drugs which stop bleeding. However, the commentaries on the varga reveal varied meanings like *Prakrutisthapana*,[4] *Vriddisthirakara*[5] and *Sthambana*[6]. Considering the above views, *shonitasthapana varga* can be comprehensively understood as producing different actions on rakta like *Raktavardana, Raktaprasadhana/ raktsamshodana* and *Raktasthambana*.

Phytochemistry is the study of chemicals produced by plants, particularly secondary metabolites. These phytochemicals have been instrumental in the discovery of natural plant products which are used as medicines, nutraceuticals and dietary supplements.[7] Probable mode of drug action can be elicited based on the phytochemicals present in them.

The action of a *dravya* can be understood in Ayurveda based on *Rasapanchaka*, however, it is imperative to establish the action of the drugs individually based on the phytochemicals present in the drugs. In the present study, *shonitasthapana varga dravyas* were screened for qualitative phytochemical analysis and the mode of action was discussed based on the phytochemicals present in *dravyas*.

Materials and Methods

Preliminary qualitative phytochemical screening was conducted for presence or absence of metabolites like alkaloids[8], flavonoids[9], saponins[10], glycosides[11], terpenoids, tannins[12], phenolic compounds, proteins[13], steroids, carbohydrates[14], fixed oils[15], resins[16], sugars[17], starch and volatile oils[18] as per the standard procedures for the *audbidha dravyas* (*Madhuka, Kunkuma, Mocharasa, Lodhra, Priyangu*) of *shonitasthapana dravyas* at Dravyaguna Laboratory, Sri Sri College of Ayurvedic Science and Research, Bengaluru in January 2024 . Physicochemical analysis was conducted for *Madhu, Mritkapala, Gairika, Sharkara*, and *Laja* at Analytical Research & Metallurgical Laboratories Pvt Ltd (ARML), Bengaluru in April 2024.

Results

The phytochemical analysis of the *Shonitasthapana varga* drugs—*Madhuka, Mocharasa, Kumkuma, Lodhra*, and *Priyangu*—revealed the following results:

- Alkaloids were absent in most, except *Mocharasa.*
- Carbohydrates, starch, sugars, steroids, tannins, flavonoids, terpenoids, phenols, and proteins were consistently present in varying combinations across all drugs.
- Glycosides were found in *Mocharasa, Kumkuma, Lodhra*, and *Priyangu*.
- Fixed oils and volatile oils were only detected in *Kumkuma*.
- Resins were notably high (+++) in *Mocharasa*.
- Saponins were present in *Madhuka, Mocharasa*, and *Priyangu*.

This analysis indicates the diversity of phytoconstituents across the group, contributing to their broad pharmacological activity. [Table 1]

The analysis of *Madhu* (honey) shows that it contains 18.65% reducing sugars, well within the limit of not more than 65% by weight (NMT 65%), and 1.06% sucrose, also below the limit of not more than 5% by weight (NMT 5%). Additionally, the presence of alkaloids, starch, carbohydrates, flavonoids, terpenoids, and proteins was confirmed, aligning with the expected results for each component. This rich composition highlights *Madhu*'s diverse biochemical properties, contributing to its therapeutic applications. [Table 2]

The analysis of *Mritkapala* revealed an iron content of 5.2%, along with 0.35% magnesium and 0.42% potassium. Notably, *Mritkapala* also contains 6.6% aluminium. These elemental compositions highlight the mineral-rich nature of *Mritkapala*, contributing to its potential pharmacological and therapeutic properties.[Table 3]

The analysis of *Gairika* revealed an iron content of 22.0%, exceeding the minimum limit of not less than 16% (NLT 16%). The presence of haematite (Fe_2O_3) was measured at 28.2%, also surpassing the required limit of not less than 21% (NLT 21%). These results confirm *Gairika*'s high mineral content, making it a valuable source of iron. [Table 4]

The physicochemical analysis of *Sharkar*a shows a sucrose content of 69.5%, which is within the acceptable limit of not more than 93% by weight (NMT 93%). Additionally, the presence of proteins was confirmed, indicating that *Sharkara* retains some nutritional properties beyond just its sugar content. [Table 5]

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The physicochemical analysis of Laja revealed a rich mineral composition, including significant levels of potassium (1246 ppm), magnesium (408 ppm), and calcium (82 ppm). The moisture content was found to be 13%, while the ash content was 1.4%, indicating the mineral residue left after combustion. Additionally, *Laja* contains 8.9% protein and 6.9% fat, contributing to its overall energy value of 388 kcal per 100 g. The high carbohydrate content, measured at 68.6%, plays a major role in the caloric contribution. This comprehensive analysis highlights *Laja*'s nutritional and elemental profile, making it a valuable component in therapeutic applications. [Table 6]

Table 1.Phytochemical Screening of *Shonitasthapana Varga Dravyas*

Phyto-Constituent	Test	*Madhuka*	*Mocharasa*	*Kumkuma*	*Lodhra*	*Priyangu*
Alkaloids [8]	Wagner's test	-	+	-	+	-
	Dragendroff's test	-	+	-	-	-
Carbohydrate[14]	Benedict's test/ Molish's test	+	+	+	+	+
Starch[17]	Molish's test	+	-	+	+	+
Sugars[17]	Benedict's test	+	+	+	-	+
Glycosides[11]	Modified Borntrager's test	-	+ (Brown ring)	+ (Green ring)	+	+ (Brown ring)
Steroids[14]	Salkowski test/ Leibermann Burchnard test	+	+	+	-	+
Tannins[12]	Ferric chloride test	+	+	+	+	+
Fixed oils[15]	Filter paper test	-	-	+	-	-
Flavonoids[9]	Lead acetate solution test	+	+	-	+	+
Terpenoids[12]	Salkowski test	+	+	+	+	+
Phenols[13]	Ferric chloride test	+	+	+	-	+
Saponins[10]	Foam test	+	+	-		+
Resins[16]	Emulsion test	-	+++	-	-	-
Volatile oils[18]	Sudan III test	-	-	+	-	-
Proteins[13]	Biuret test	+	+	+	+	+

Table 2.Physicochemical Analysis of *Madhu*

Parameters	Results	Limits
Reducing sugars	18.65	NMT 65% by wt
Sucrose	1.06	NMT 5% by wt
Alkaloids	Present	-
Starch	Present	Present
Carbohydrates	Present	Present
Flavonoids	Present	Present
Terpenoids	Present	Present
Proteins	Present	Present

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Table 3.Physicochemical Analysis of *Mritkapala*

Test Parameters	Unit	Test Results	Limits	Test Method
Iron as Fe	%	5.20	NA	ICP – OES
Magnesium as Mg	%	0.35	NA	
Potassium as K	%	0.42	NA	
Aluminum as Al	%	6.60	NA	

NA: Not available
ICP-OES: Inductively Coupled Plasma Optical Emission Spectroscopy

Table 4.Physicochemical Analysis of *Gairika*

Test Parameters	Unit	Test Results	Limits	Test Method
Iron as Fe	%	22.0	NLT 16%	ICP - OES
Haematite as Fe_2O_3	%	28.2	NLT 21%	

Table 5.Physicochemical Analysis of *Sharkara*

Parameters	Results	Limits
Sucrose	69.5%	NMT 93% by wt
Proteins	Present	Present

Table 6.Physicochemical Analysis of *Laja*

Test Parameters	Unit	Test Results	Test Methods
Sodium as Na	ppm	32.0	ICP – OES
Iron as Fe	ppm	49.0	
Calcium as Ca	ppm	82.0	
Zinc as Zn	ppm	88.0	
Magnesium as Mg	ppm	408.0	
Potassium as K	ppm	1246.0	
Selenium as Se	ppm	0.8	
Moisture	%	13.0	IS: 7874 (P-1):1975
Ash	%	1.4	
Protein	%	8.9	
Fat	%	6.9	
Carbohydrates	%	68.6	By difference
Energy	kcal/100 g	388.0	By calculation

IS: Indian Standards

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Discussion

Madhu: Flavonoids and polyphenols present in honey have demonstrated radical scavenging activity which interact with red blood cell membrane inhibiting the breakage induced by mitomycin C in Fanconi anaemia.[19] Sugar (glucose) and maltose in honey interfere with the coagulation through mechanisms like non-enzymatic glycation and decrease in subendothelial heparin sulphate thereby possessing anti-coagulant properties.[20] Quercetin, a flavonoid of honey exhibited a significant increase in RBCs and a decrease in MCV, MCH and ferritin in non-alcoholic fatty liver disease.[21] On healthy individuals, honey increased haemoglobin, packed cell volume, monocytes, eosinophils, lymphocytes, blood zinc, serum iron and decreased plasma ferritin.[22]

Madhuka: *Yashtimadhu* showed the presence of carbohydrates, steroids, tannins, flavonoids, terpenoids, phenols, saponins and proteins. *Madhuka* consists of a triterpenoid saponin (Glycyrrhizin) which has shown non-haemolytic activity on human red blood cells.[23] A study conducted on subjects of digestive tract cancer treated with chemotherapy and glycyrrhizin presented significantly lower liver transaminase levels and increased levels of neutrophils, granulocytes, and white blood cells when compared with only chemotherapy.[24] Yashtimadhu possess flavonoids like isoliquiritigenin, glabridin, quercetin and kaempferol. Glabradin exhibited the highest inhibitory effects on collagen-stimulated platelet aggregation and moderate effects on arachidonic-acid-stimulated activation in humans and mice.[25] Quercetin showed a protective effect against hypotonic haemolysis.[26] Kaempferol exhibited inhibition of the enzymatic activity of thrombin, fibrin polymer formation, thrombosis and platelet activation in animal models.[27] Isoliquiritigenin also exhibited anti-platelet action *in vitro* when compared with aspirin.[28]

Kunkuma: Analysis of *Kunkuma*, indicated the presence of glycosides, steroids, tannins, fixed oil, terpenoids, phenols and volatile oils. Crocetin, a diterpenoid and Crocin, a glycoside are two important compounds isolated from *Kunkuma*. Crocetin reduced collagen-induced platelet aggregation along with prolonged time in occlusion of carotid artery thrombosis in rats.[29] Crocin was also found to exhibit protection against morphological alterations of human erythrocytes caused by hypochlorous acid.[30] Safranal, a monoterpene aldehyde showed a preventive effect on the total and differential count of WBC in the blood of sensitised guinea pigs.[31]

Mocharasa: Gum resin of *Shalmali* revealed the presence of terpenes, tannins, flavonoids, steroids, phenols and glycosides. Lupeol, a triterpene decreased inflammatory cell infiltration and increased proliferation of fibroblasts, vascularisation, and deposition of collagen fibers showing potent styptic action.[32] It enhanced wound healing in streptozotocin-induced hyperglycaemic rats with modulatory effects on inflammation, oxidative stress, and angiogenesis.[33] An *in vitro* study on *Bombax pentadrum* reported antisickling activity in the management of Sickle cell anaemia due to the presence of anthocyanin flavonoid.[34] However, gallic acid attenuated platelet activation and platelet-leukocyte aggregation.[35]

Lodhra: *Lodhra* showed positive results for alkaloids, glycosides, tannins, terpenoids, flavonoids, carbohydrates, starch and protein. The pharmacological activity of *lodhra* is attributed to its phenolic glycosides like symplocoside, terpenoids (betulinic acid), flavonoids (Quercetin)[36] and alkaloids (loturine and loturidine). Anti-haemorrhagic potential has been reported by a decrease in whole blood coagulation time, prothrombin time and fibrinolytic activity.[37] Haemostatic activity in *asrgdhara* (menorrhagia) of *Lodhra* is reported clinically.[38]

Priyangu: Preliminary phytochemical analysis of *priyangu* showed the presence of carbohydrates, sugars, glycosides, flavonoids, terpenoids, tannins, protein and phenolic compounds. A case study on idiopathic thrombocytopenia treated with a formulation consisting of *priyangu* as an ingredient showed a significant increase in platelets.[39] Polysaccharides isolated from *priyangu* showed *in vitro* growth stimulatory effect on isolated normal lymphocytes thereby possessing anti-oxidant activity.[40] Oils isolated from aerial parts of *priyangu* showed Fe^{+} ion chelating activity attributing to the presence of terpenoids like B-selinene and flavonoids in the drug which helps in promoting haematopoiesis.[41] *Priyangu* is reported to be indicated in external and internal bleeding which may be due to the presence of tannins which act as a haemostatic agent.[42]

Mritkapala: Physicochemical analysis of *Mritkapala* indicated the presence of iron, magnesium, potassium, and aluminium. No major pieces of evidence are available on the utility of *Mritkapala* based on the elements present in it, however, trace elements like iron act as catalysts in enzyme systems by participating in oxidation reactions in energy metabolism and playing a vital role in the transport of oxygen as iron is the constituent of haemoglobin and myoglobin.[43] Magnesium plays an essential role in normalising cardiac function and averting abnormal cardiovascular clotting thereby reducing cardiac attacks and cerebrovascular strokes.[44] Potassium acts as vasoactive by stimulating the vascular smooth muscle leading to an increase in blood flow.[45]

Gairika: *Gairika*, a mineral compound is red oxide of iron or haematite with a chemical formula Fe_2O_3 iron as the main component (> 16%) is indicated in anaemia.[46] It is also found to be effective in menorrhagia due to its potent astringent and styptic action.[47]

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Sharkara: Sugars enhance iron bio-availability probably through either chelating or altering the oxidation state of the metal. They increase non-heme iron bio-availability in human epithelial intestinal and liver cells.[48] In Ayurveda, we do not come across intravenous administration of drugs, however, modern researchers have found that iron sucrose, which is a combination of sucrose and iron (III) hydroxide is extensively used in the treatment of anaemic cancer patients[49] and in iron deficiency anaemia.[50] *In vitro* studies have also shown that sugar used as a vehicle for iron fortification increased the absorption of iron by more than 50%.[51]

Laja: Rice fortification with iron and vitamins and minerals (vitamin A, zinc, folic acid, selenium, magnesium) is a technique used to improve the haemoglobin[52] and alleviate micronutrient deficiency.[53,54] Physico-analysis of *laja* in the present study revealed the presence of iron, calcium, zinc, magnesium, potassium, sodium, selenium etc and is a rich source of energy and protein. Therefore, *laja* increases the haemoglobin content and can be considered a staple diet or food for different types of anaemia and other deficiency disorders.

Conclusion

Analysis/ screening of the chemical constituents and their pharmacological activities present in the *shonitasthapana varga dravyas* showed that the *shonitasthapana varga dravyas* possess a varied pharmacological activity. Drugs like *Madhu, Gairika, Kunkuma, Laja* may help in *raktavardhana*; *Madhuka, Priyangu, Sharkara* for *raktaprasadana*; drugs like *Mocharasa, Mritkapala* and *Lodhra* for *raktasthambana karma*. There may be a wide scope of using these dravyas in conditions like anaemia, and bleeding disorders, as adjuvant to cancer therapies etc.

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