

THE PHYTOCHEMICAL AND PHARMACOLOGICAL BASIS OF AYURVEDIC PLANTS USED IN TREATMENT OF LEUCORRHOEA AND MENORRHAGIA

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Abstract : Ayurveda is one of the most ancient and scientific medicinal systems in the world. Apart from anatomy, physiology and the 8 branches, i.e. *Ashtanga Ayurveda*, several modes of therapy and more than 2000 medicinal plants have been described in ancient texts. Leucorrhoea and menorrhagia are two common disorders in women of reproductive age and Ayurvedic texts are replete with *shlokas* mentioning the use of hundreds of medicinal plants to be used for these disorders. However it is neither feasible nor ideal to use too many plants in all subtypes of the diseases, and since these specifications are not provided in the cryptic *shlokas*, it has become necessary to select the plants based on their Phytochemical, Ayurvedic and Experimental Pharmacological properties. In this paper we have briefly reviewed our work and suggest standard as well as novel aspects of properties of medicinal plants which should be considered in the development of effective remedies for leucorrhoea and menorrhagia. Investigations like cervical and vaginal cytology, ultrasonography, hormone assays and microbiological techniques can help us in identifying the subsets of patients and selecting plant combinations which will be useful in individualization of therapy.

Keywords : Leucorrhoea, Menorrhagia, Ayurveda, Medicinal plants, Toxicity testing.

Introduction

Ayurveda is simultaneously the most ancient, concurrent and futuristic science of health and disease. This is due to the fact that its roots are based firmly on fundamentals of astute observation, scientific experience, experimentation and intelligent derivations i.e. on the basis of *Aapta, Pratyaksha, Pramana* and *Anumana*.

However, whilst the science must have flourished in the golden ancient era, just as the sun gets eclipsed, this science was eclipsed in the medieval ages, particularly after the 16th century and remained in the shadows for a long time. Due credit must be given to the Ayurvedic physicians through the centuries for keeping the science alive and available for the benefit of mankind today and for the future.

Women form about 50% of the world population and contribute equally to the work force as well as towards propagation of life. Ayurveda is rich in the exposition of therapeutics of two common disorders of women, leucorrhoea and menorrhagia (**Charaka, Sharangdhara, Kashyapa, Bhava Mishra, Bharat Bhaishajya Ratnakar**).

The present review is directed towards an analysis of current knowledge on Ayurvedic plants used in the treatment of these two conditions and highlights some research areas to make the treatment more effective and safe.

Relevance Today

Leucorrhoea is the commonest disorder affecting women and although it may be caused

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by physiological conditions like pregnancy or intrauterine contraceptive devices, in the vast majority of cases it is caused by Reproductive Tract Infections (RTIs) and very often by Sexually Transmitted Infections (STIs) (**Guaschino S et al., Hawkes et al.**). Due to the changing life styles, the STIs or *Agantuk rogas* are assuming epidemic proportions all over the world and India is no exception. The sequelae include menorrhagia, dysmenorrhoea, Pelvic Inflammatory Disease (PID), infertility, ectopic gestation, leucorrhoea, pain, sexual dysfunction, cancer cervix, HIV susceptibility, intolerance to IUDs, arthritis, conjunctivitis, skin lesions, hepatitis, urethritis, warts etc. in the females; orchitis, vasoepididymitis, urethritis, prostatitis, warts, infertility, penile cancer etc. in the males, and neonatal meningitis, prematurity (with possible mental retardation), congenital anomalies, papillomas etc. in the children.

About one third of the women in reproductive age group may suffer from various RTIs (**Guaschino S et al., Hawkes et al., CDC Kulkarni et al., Prasad et al.**). Most of these are consequences of sexual indiscriminate promiscuity (multiple sex partners). The ill effects of such an unhealthy lifestyle on women's health have been aptly described in the chapters on *yonni - vyapad* chapters in Ayurvedic texts (**Charak, Bhava Prakasha**).

Avoidance of sexual intercourse due to dyspareunia as well as symptoms like leucorrhoea and itching can lead to a reduced quality of life in women. In the leucorrhoea clinic 16 % of our cases gave history of dyspareunia and 47.7 % of patients complained of low abdominal pain (**Joshi JV et al. 2004**). Majority of them said that they had avoided sexual intercourse since the onset of dyspareunia.

In some community studies the prevalence of RTIs has been shown to be as high as 30% in women in reproductive age. In our experience various RTIs were observed in about 1/3rd women from the contraceptive clinics, presumably from a relatively low risk population. In women from STD clinics the incidence was much higher (**Hawkes and Santhya, Joshi JV et al. 1993, Mali BN et al., Palayekar V et al.**).

Menorrhagia : Menorrhagia is another common condition afflicting young women. Not only does it lead to anaemia with its trail of symptoms of weakness, giddiness, backache, edema, congestive heart failure and collapse in extreme cases, it also leads to increased susceptibility to other systemic infections and local infections like bacterial vaginosis. Anaemia in pregnancy leads to prematurity, still birth and children born with iron deficit. In our experience 96% of a rural antenatal group (N=413) had anaemia as per WHO definition i.e. Haemoglobin level below 11 gms% (**Joshi JV et al.**). Anaemia, deficiency of nutrients and trace elements may be associated with the malfunction of several key enzymes in the body including the brain (**Sen et al.**). No doubt nutritional deficiency is the major cause, and must be attended to, however in young school girls and women, menorrhagia is the commonest compounding factor. IUD induced menorrhagia is another common problem in the reproductive age group (**Grimes et al.**).

Both these entities therefore lead to huge national, economic and social losses.

Lacunae in current treatment

Excellent studies with microbiological culture or other advanced biotechnological techniques have helped in the identification of more than twenty microbial causes of various RTIs. Pharmaceutical advances have provided

novel antibiotic/ antiviral agents. However, the problem of drug resistance reigns supreme in most diseases. Commonly required drugs like ampicillin, fluroquinolones, doxycycline, metronidazole and antivirals may face drug resistance in upto 20% of cases. The list of possible side effects ranges from weakness, nausea and vomiting to skin rashes and liver, renal or bone marrow suppression (**Ray et al., Somani et al., Grimes et al.**).

The treatment of menorrhagia also leaves much to be desired (**Osei et al.**). In menorrhagia surgical methods like Transcervical Surgical Resection of Endometrium (TCRE) and laparoscopic removal of fibroids and in extreme cases hysterectomy are no doubt effective procedures but are expensive and beyond the reach of common patient. Moreover, these are used generally in those who do not desire childbearing and most of the younger women carry on with minor or major degrees of menorrhagia throughout their lives.

Structural or organic causes of menorrhagia like polyps, fibroids and ovarian tumours have to be dealt with surgically. A large majority of women with idiopathic menorrhagia or Dysfunctional Uterine Bleeding (DUB) use either exogenous steroids like norethindrone, medroxyprogesterone acetate or combination pills or prostaglandin synthetase inhibitors like naproxen, or mefenamic acid. Agents affecting local capillary permeability are less effective (e.g. rutine, Vitamin C & K) or are expensive (adrenochrome, diosmin). Some of these drugs can cause side effects and some times serious intestinal haemorrhages or water retention and edema, or hepatitis, can result. Another group of drugs is the procoagulant type i.e. Tranexamic acid. This again has the hazard of venous thrombosis in a rare case (**Osei et al., Roy and Bhattacharya, Grimes et al.**). In the

Cochrane analysis however it was observed that the incidence of thrombosis because of tranexamic acid is not more in users than those in the controls (**Lethaby et al.**). Progestins, specially intrauterine devices are also a good alternative (**Duckitt K**). Recent introduction of TSH screening and availability of Thyroid Replacement Therapy can be very useful in the treatment of hypothyroidism as a cause of menorrhagia (**Shringi et al. 2004**).

When the current management of leucorrhoea by Ayurvedic therapy is considered one finds that the therapies which are used consist of use of individual plants as well as formulations which may contain as many as 40 plants. Over the centuries, the scientific basis for use of individual plants or formulations has not been investigated nor documented systematically. Since any individual plant may have several compounds, a formulation may have more than 1000 actives. This may be quite unnecessary. Moreover the inclusion of several plants in a formulation requires the standardization of each of those plants. It is unlikely that the pharmaceutical industries with financial interests are able to do this fully and this aspect has been relatively neglected with few exceptions.

Scope for Ayurvedic therapy

The etiopathology and management of leucorrhoea and menorrhagia has been described in the Charak, Kashyap and other Samhitas and in other texts like the Bhav Prakash. Besides several other *Granthas* and *Nighantus* (**Bharat Bhaishajya Ratnakar**) describe the treatment of women's diseases or the *yoni - vyapad*. A systematic description is provided in text books for medical students of Ayurveda (**Tewari Premavati, Joshi Nirmala**). It is estimated that a substantial proportion of India's population depends on indigenous or traditional systems. Many Indian medicinal

plants have been found to be effective in the treatment of leucorrhoea and menorrhagia. These therapies usually can be administered without any severe side effects, and are acceptable and less expensive. They are based on Ayurvedic principles of the *tridosha sanchaya- prakopa- prasara- sthanasanshraya- vyakti - bheda*.

The presence of multiple ingredients in a formulation presumably allows the targeting of activity at various levels like uterine tonicity, coagulation defects, capillary permeability, hormonal imbalance, psychosomatic causes like depression etc. However if any number of plants are included without consideration of potency, drug interactions or quality control the therapy may become ineffective as well as expensive.

The Ayurvedic therapy however will have to be evaluated with well designed clinical trials of efficacy, side effects and clinical biochemistry to document absence of subclinical harmful effects on hematology and other organ function tests if it has to be universally acceptable.

Reverse Pharmacology Approach

Ayurvedic medicine is practiced by a large segment of Indian population and it is also becoming popular in countries like the USA, UK, Australia and some European countries. Thousands of phytocompounds are also being studied *in vitro* and *in vivo* studies in advanced laboratories like the National Institute of Health (NIH).

However these laboratories usually concentrate on the isolation of pure compounds. These are investigated as NCEs (New Chemical Entities) which then have to undergo stringent preclinical and clinical phase 1, 2 and 3 clinical trials before the suitable drug is

marketed. Thousands of patients are then exposed to the drug, but if a side effect is rare or develops only after prolonged use, thousands of patients remain exposed to the risk.

The number of NCEs being withdrawn from the market due to adverse side effects, in recent times, is phenomenal (**Lasser KE et al.**), highlighting the difficulties in the development of new drugs. This path is both lengthy and expensive as millions of dollars are spent before the NCE hits the market. Live Ayurvedic practices offer a unique opportunity for human pharmacological studies to document safety and efficacy by bringing in sophisticated methods like Cytology (e.g. Papanicolaou smears), Colposcopy, Ultrasound, Endocrine and Metabolic assays, Clinical Blood Biochemistry, Microbiology and tools like Epidemiological and Statistical evaluations.

This Reverse Pharmacology Approach has grown into a discipline where its stages are well defined (**Vaidya RA et al., Patwardhan B et al.**). This approach is currently being used for Diabetes mellitus (multicentric CSIR project) and is also being used for documenting the lower risk/ benefit ratio for the large number of currently used medicinal plants, *choornas* and formulations, in women with leucorrhoea and menorrhagia, and also for other problems in women's health like the menopausal syndrome (**Pandey et al., Joshi JV et al.**).

There is a need to rationalize the use of all ingredients that are used in a particular formulation if we have to make progress in the development of effective and safe and economical Ayurvedic preparations.

Background work

We have observed the relief in >85% of cases of leucorrhoea with the local vaginal use of the modified *Panchavalkal kwath*

(Joshi JV *et al.* 2004, 2005) and in another study with an oral Ayurvedic formulation (Joshi *et al.* 2003), when objective methods like symptom scoring, cytology (Pap smear), colposcopy, vaginal pH and microbial culture were applied for evaluation before and after therapy. The need for systemic administration of appropriate *dravyas* was felt in the presence of systemic symptoms like bodyache, heaviness, malaise and pain. As is shown below in

Figure 1 and **Figure 2** a Pap smear, or colposcopy as in **Figure 3** and **Figure 4**, may show simple bacterial vaginitis or a precancerous condition (Cervical Intraepithelial Neoplasia or CIN) or cancer in an apparently simple case of cervicitis or erosion.

We have found naproxen sodium very effective in a placebo controlled trial on IUD induced menorrhagia but indomethacin produced side effects (Chadha *et al.*). Similarly a

Figure 1 & 2. Cytologic evaluation of cases presenting with leucorrhoea

Papanicolaou smear X 400 magnification

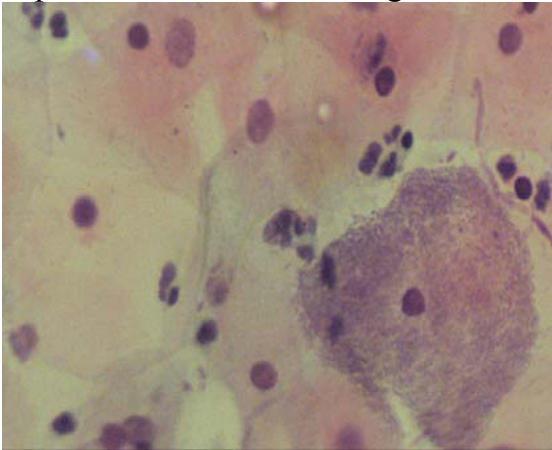


Fig 1. Clue cell with covering bacteria

Papanicolaou smear X 400 magnification

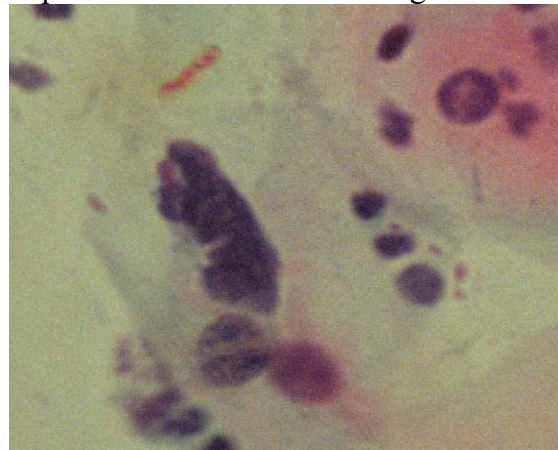


Fig 2. Enlarged nuclei in pre-cancer

Figure 3 & 4. Colposcopic visualization after application of 5% acetic acid to the cervix for assessment of cases with leucorrhoea

Colposcopy X 10 magnification



Fig 3. Cervicitis with congestion

Colposcopy X 10 magnification



Fig 4. Cervical intraepithelial neoplasia

formulation with *Saraca asoka (indica)* as the major ingredient was effective in >85% of cases of Dysfunctional Uterine Bleeding (DUB) when investigations like Papanicolaou smear, pelvic sonography, serum TSH, and blood counts were used to exclude organic causes. Objective methods like symptom scoring, menstrual diary cards, pelvic sonography, specially designed case record form and pad counts were used in pre-therapy cycle and 3 treatment cycles **Figure 5 (Shringi et al. 1999)**. These therapies were associated with minimal or no side effects.

Need for new Ayurvedic formulations

Despite the extensive use of traditional therapies there is very little documentation of the efficacy or safety of Ayurvedic therapies in the form of objective studies. The widespread general belief that all Ayurvedic or herbal therapies are effective or safe is not justified (Holstege et al., Wu et al.). Neither Allopathic nor Ayurvedic therapies can claim to be totally free of side effects.

Postmarketing surveillance and long term studies alone can define the actual risk/ benefit ratios.

Figure 5 shows Mean \pm SD number of pads used by 22 cases of ovulatory menorrhagia before treatment, and during 1st, 2nd and 3rd

Pad count as an indicator of therapy for menorrhagia

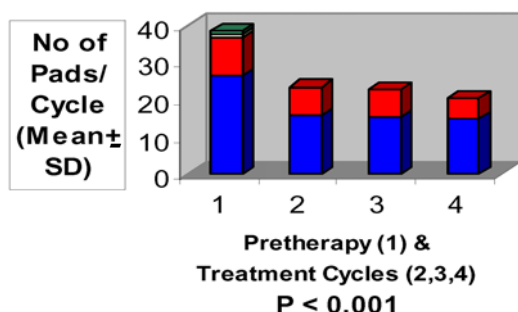


Fig 5. Pad count as a semiquantitative method in the evaluation of menorrhagia Mean \pm SD number of pads in pretherapy cycle 0, and in 3 treatment cycles.

treatment cycles with an oral Ayurvedic formulation containing *Saraca asoka (indica)*.

Scientific use of Ayurvedic medicines

Treatment of the couple in STIs: The original Ayurvedic texts describe the preparation of the couple prior to conception, however in the current Ayurvedic practice the treatment of the couple as a whole, even if one of them comes up with symptoms of RTIs, is a rarity. In none of the 400 cases of leucorrhoea in an Ayurvedic hospital the husband was treated unless the patient complained of infertility. A similar trend, to a lesser extent, was also seen in women who came for treatment of leucorrhoea after earlier treatment from Allopathic gynecologists also and only about 10% reported that husbands were also treated. After we explained to the women, sometimes jointly with the husband, more than 90 % of husbands took treatment for STIs (Joshi et al. 2004).

Physico-chemical properties

Ayurvedic properties and Pharmacological activity of drugs for (a) Leucorrhoea and (b) Menorrhagia.

Correlation of Ayurvedic properties with phytochemistry and pharmacology :

The Ayurvedic classification of drugs or *dravyas* as per their *rasa* or taste appears to be hypothetical on superficial thinking. However recent studies in phytochemical analysis and in taste neurophysiology indicate how well the ancient Rishis had classified *dravyas* according to their properties. The 6 primary *rasas*, *madhura*, *amla*, *lavana*, *katu*, *tikta* and *kashaya*, not only indicate the taste of that *dravya* but possibly hint at their chemical composition and pharmacological action. For example, the *rasa* of Yashtimadhu or *Glycyrrhiza glabra* is given as *madhur* and *kashaya*. This means that not only does it taste sweet but it also has astringent properties.

These substances are known to be anti-inflammatory and useful in the treatment of specific infections. The polypeptides and flavonoids have wound-healing properties which help in the control of leucorrhoea and healing of erosions and ulcers. *In vitro* studies have shown the antiviral activity of this plant, and this is likely to have potential antiherpetic and anti HIV activity. The *rasayana* and immunomodulatory properties have been shown for six Ayurvedic *dravyas* in experimental models (**Rege et al.**).

A brief analysis of the Ayurvedic and Phytochemical properties of some common plants used in the treatment of leucorrhoea (**Tables 1,2**) and menorrhagia (**Tables 3,4**) is given in a tabulated form (**Badam, Bedoya, Bhava Prakash, Biswas et al., CCRAS, Chakrabarti and Mukerji, Charak, CHEMEXCIL, Gogte, Duggal and Misra, Gupta and Tandon, ICMR, Khan and Javed, Rastogi and Marhotra, Sharma et al., Pompei**). A careful study of such properties can lead to the desired combination of plants for a particular indication. The tables give a summary of properties of 8 plants used primarily for leucorrhoea and 8 plants used primarily for menorrhagia. Due to complementary actions and some common properties plants mentioned in both tables can be used for either of the clinical conditions and indeed many classical formulations contain plants from both tables. Moreover these tables are prepared to serve only as examples since the Ayurvedic literature is so rich and vast that it is not possible to tabulate all the relevant plants.

Correlation between *rasa* and pharmacological actions

It is only recently that the modern experimental science has elucidated some of the complex phenomena that may occur on tasting a substance. A definite indication of a relationship between the substance tasted and

its first sensory and post – ingestive properties has been put forth in 2006 (**Bourre JM, Chandrashekhara et al., Simon et al.**). This may correspond with the *rasa* and *vipaka* in Ayurveda. The Rishis may not have known the anatomic nerve connections but had inferred accurately the correlation between *rasa* with the pharmacologic effects of many medicinal plants.

Whilst Ayurvedic literature has always documented 6 *rasas*, the modern science for a long period recognized the receptors only for 4 tastes (sweet, bitter, sour and salty). Only recently have receptors for the fifth or the Umami (or pungent) taste which may be the equivalent of *Katu rasa* in Ayurveda have been identified by modern scientists (**Maruyama et al.**). It is very important though to learn about the methodical ways of modern laboratory science as the scientists have struggled to identify and learn the functions of the various types of taste receptors and their neurogastronomic connections.

Another aspect is the correlation between the *rasa* and *doshagnata*. These were not hypothetical concepts as we have said earlier, but distinct categories of chemical entities such as the bitters, representing the alkaloids or anthroquinones, the sweets representing the carbohydrates or polypeptides and the *kashayas* representing the astringents and so on. Many active principles have bitter taste (**Drewnowski et al.**). These have antibacterial, antiviral, anti-inflammatory and wound healing properties. The credit for correlation of taste or *rasa* with health, disease and pharmacological actions however goes to the incredible astute observations of ancient Ayurvedic Rishis.

The third aspect of *guna*, i.e. *laghu, ruksha, guru, snigdha* etc., is something which needs further research. For example although *snigdha* is not a *rasa*, Ayurveda has identified substances which have this property of binding together or holding together. How the substances

were classified as per their ability to produce bodily changes like anabolism and catabolism, energisers or those producing heaviness which comes from fluid retention or from lethargy or muscle weakness, is beyond the understanding of the common interpretation. The intelligent and seemingly mysterious way of deduction and formulation for therapeutic benefit was lost in the medieval ages and the Ayurvedic prescriptions became long lists of *dravyas* which were difficult to prepare, difficult to ingest in the crude form and poor in quality. Some of the formulations that currently flood the markets are full of unnecessary and probably ineffective preparations. There is a definite need to minimize the number of plants to be used and to market reliable standardized formulations.

As an example we can take the following formulation for leucorrhoea:

Ashwagandha 30 mg.
Shuddha hirasol 30 mg.
Shuddha kasis bhasma 30 mg.
Kukkutandatwak bhasma 30 mg.
Dhavidiful 25 mg.
Ragatrohido 25 mg.
Shuddha praval bhasma 25 mg.
Haritaki 25 mg.
Amla 25 mg.
Haridra 25 mg.
Daru haridra 25 mg.
Bibhitaki 25 mg.
Hapusa 25 mg.
Shuddha lauha bhasma 25 mg.
Shimlo 45 mg.
Shuddha guggulu 45 mg.
Shatavari 45 mg.
Shuddha trivang bhasma 45 mg.
Lodhra 45 mg.
Vadchal 15 mg.
Shuddha shilajit 15 mg.
Borasalli chal 15 mg.

This formulation has 22 plants or ingredients and as we have seen from the phytochemical analysis in the tables each plant

or ingredient may have at least 5 to 10 active compounds. This means that we are bombarding the human system with about 100 or more compounds for a condition which the Allopathic drugs can cure with only 2 or 3 compounds. This does not seem logical and whilst emphasizing the efficacy of Ayurvedic medicinal plants one also should accept the need to reduce the number of ingredients to the minimum essential so that therapy is effective and well standardized. The texts do mention long lists of plants which could be used in leucorrhoea but it may not be implied that all of them should be used. Surely the combination of *dravyas* (plants) could be based on the intelligent selection of *dravyas* based on the type, stage and complications of disease, patient's immunity, availability of reliable material in that geographical region etc. Moreover the dose of each constituent also should be rationalized as per the disease, age, severity of condition etc. There is very little documentation or publication to which one can refer for guidance regarding doses per day or duration of therapy specially with respect to efficacy and side effects (**Table 1**).

Structure-function-relationships

Phytochemical analysis of Ayurvedic medicinal plants has shown the presence of many bioactive principles. Plant extracts, or in a few experiments the isolated compounds, have been shown to have many pharmacological actions in cell cultures, experimental animals or in some clinical studies. Several phytoconstituents have been structurally analysed and show a remarkable resemblance to hormones or to pharmacological agents like antibiotics or other pharmacological compounds. It is not possible to review all such compounds but as an example one can see the similarity in chemical structure of the hormone estrogen and one of the phytoconstituents of *Yashtimadhu* (*Glycyrrhiza glabra* Linn), glycyrrhizin.

Glycyrrhizin is converted to Glycyrrhetic acid which has been shown to be a strong antioxidant (Ablise M *et al.*).

Estradiol is also a very strong antioxidant. Hundreds of compounds have been identified from the plants listed above and there may be unidentified compounds. Hence it would be appropriate to select the plants for a particular indication on the basis of known phytoconstituents but also consider the Ayurvedic properties as the Ayurvedic texts and *sutras* would have considered the overall activity inclusive of known and unknown compounds as well as efficacy in different dosage forms (Figure 6).

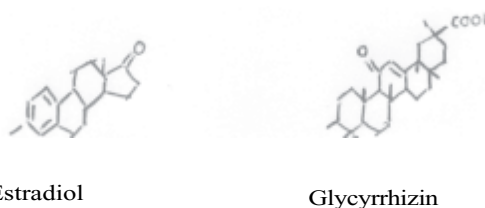


Fig. 6. Schematic chemical structures of estradiol and glycyrrhizin

Prakriti and therapeutics

The importance of determination of *prakriti* and *dosha-prakopa* cannot be underestimated in the management of both leucorrhoea and menorrhagia. As a matter of fact this is an advantage with Ayurvedic

Table 1. Ayurvedic properties of medicinal plants used in the treatment of Leucorrhoea.

Name of Plant	Kula	Guna	Rasa	Veerya	Vipaka	Doshagnata
Yashtimadhu (<i>Glycyrrhiza glabra</i> Linn)	Shimbi	Snigdha Guru	Madhur	Sheeta	Madur	Dosha-Pitta Vataghna Dhatu-Shukra, Rakta, Majja, Rasayani Mala-Mutramargagami Organs-Urinary Bladder
Shatavari (<i>Asparagus racemosus</i>)	Rason	Laghu Snigdha	Madhur Tikta	Sheeta	Madhur	Dosha-Vata-Pitta-Kaphaghna Dhatu- Rasayana,Majja, Shukra Rasa,Rakta Mala- Purisha Organs- Eyes,Stomach, Liver,Gall Bladder,Heart, Uterus, Galactagogue Aphrodisiac, Abortion, Menorrhagia
Nimba (<i>Azadirachta indica</i> Linn)	Nimba	Laghu	Tikta Kashay	Sheeta	Katu	Dosha-Kapha, Pittaghna,Vatavardhak Dhatu-Rakta,Meda Mala- Urine, Purisha Organs-Stomach,Eye,Uterine Stimulant
Kamal (<i>Nelumbo nucifera</i>)	Kamala	Snigdha Pichchila	Madhura	Sheeta	Madhura	Dosha-Kaphapitta Hara Chatu-Majja, Rasa, Rakta Mala- Urine, Purisha Organs- CNS, CVS, Genitourinary Skin, Antiabortifacient, Pregnancy
Dhataki (<i>Woodfordia flori bunda</i>)	Dhayati	Laghu Ruksha	Kashaya Katu	Sheeta	Katu	Dosha – Pitta Shamak Dhatu-Rakta, Majja Mala, Purisha Organs-Vaginal Discharge
Musta (<i>Cyperus rotundus</i>)	Musta	Laghu Ruksha	Katu Tikta Kashaya	Sheeta	Katu	Dosha-Pitta Kaphaghna Dhatu-Rakta ,Rasa,Meda Stanya Mala –Purisha Organs-Blood, Skin, Breasts
Shirish (<i>Albizia lebbak</i>)	Shimbi	Laghu Ruksha Tikshna	Kashaya Tikta	Mild Ushna	Katu	Dosha – Tridosha (Shaman) Dhatu – Rasa (Skin) Rakta (Herpes) Organs- Skin, Respiratory
Ashvattha (<i>Ficus religiosa</i>)	Vata	Guru, Ruksha	Kashaya	Sheeta	Katu	Dosha – Kphapittashamak Dhatu – Rakta , Skin Shukra – Purisha & Mutra Organs - Ulcer Healing, Astringent Skin, Genitourinary, Pregnancy

medicines which needs to be preserved with better usage of selected fewer medicines.

In our experience (**Nabar et al.**) the use of *Panchavalkal kwath* for leucorrhoea was most beneficial to those with the *pitta prakriti* and also in those with *pittaprakopa* as has been described in the Ayurvedic texts and this should be used to advantage by the practising Ayurvedic physicians. These nuances are described in some texts (**Tewari Premvati, Joshi Nirmala**) also but not followed in general practice when commercial preparations with a large number of ingredients are used.

Side effects and drug interactions

Absence of side effects or safety is the general umbrella which the Ayurvedic

marketing forces have tried to use for influencing public opinion. Whilst it is true that by and large serious side effects are rare with medicinal plants, one cannot ignore the side effects or drug interactions reported by the Western literature on herbal extracts (**Holstege, Ernst, Wu**). It is possible that most of the toxicity of formulations containing *bhasmas* may be because of improper preparation. However the onus will lie on the Ayurvedic community to show this. We must also accept that the side effects and contraindications are mentioned in texts, e.g. *kaphavardhak*, *pittavardhak*, *vatavardhak* etc. but are largely ignored in marketing labels and in general practice e.g. Nimba is *vatavardhak*. There are few studies where sufficient numbers of patients have been treated

Table 2. Phytochemical and Pharmacological properties of common medicinal plants used in the treatment of leucorrhoea.

Name	Phytoconstituents	Pharmacology
Yashtimadhu (<i>Glycyrrhiza glabra</i> Linn)	Triterpene saponins-glycyrrhizic acid, Flavonoids & isoflavonoids, Liquiritin, coumariin, coumestan derivatives, phytosterols-stigmasterol, onocerin, β -sitosterol, β -amyrin Volatile oil – anethole estragole, eugenol, hexanoic acid	Antiulcer, Hepatoprotective, Antioxidant, Antimicrobial, Antiviral, Anticancer- Antitumour & Antimetastatic, Antimutagenic, Anti-inflammatory
Shatavari (<i>Asparagus racemosus</i>)	Steroid, glycosides, aglycones shatavariin Alkaloids -quercetin, hyperoside, cynidin-3-galactoside	Anticancer, Adaptogenic Activity, Antibacterial, Antitussive, Antiprotozoal, Antiulcer, Galactagogue Activity, Immunomodulatory Activity, Molluscicidal Activity
Nimba (<i>Azadirachta indica</i> Linn)	Nimbidin, Nimbolide, Gedunin, Mohamoodin, Azadirachtin, Gallic acid, catechin, epicatechin, margolone, margolonone, polysaccharides, peptidoglycan	Anti-inflammatory, Antibacterial, Antifungal, Antiproliferative, Anticancer, Immunomodulatory, Spermicidal, Antipyretic, Antiarthritic, Hypolipidaemic
Kamal (<i>Nelumbo nucifera</i>)	Nuciferine, quercetin, kaempferol, sterols, flavonoids, alkaloids, tannins, saponin, glycosides, Betulinic acid, a triterpene, complex of polysaccharides	Anti-inflammatory Activity Comparable to Betamethasone and Phenylbutazone Antioxidant, Haemostatic, increases Thermogenesis
Dhataki (<i>Woodfordia floribunda</i> Kurz)	Octacosanol, β -sitosterol ellagic acid, polyphenols	Ellagic Acid, has Astringent and Haemostatic it also affects Histamine Release, Anti-leucorrhoeal, Anti-menorrhagia.
Musta (<i>Cyperus rotundus</i> Linn)	Essential oils-sesquiterpene hydrocarbons (25%), epoxides(12%) Monoterpene&aliphatic alcohol(25%) cyperone rotundines A-C ³ β -selineue, caryophyllene-6, 7 oxide Triterpenes - β sitosterol	Antiemetic, Anti-inflammatory, Antipyretic, Antimalarial, Antiobesity, Cytoprotective, Effect on Pigmentation, Oestrogenic, Tranquilliser, Hypotensive, Muscle Relaxant, Antibacterial
Shirish (<i>Albizia lebback Benth</i>)	Tannins, leucocyanidins, Albiziahexoside d-catechin, lebbecacidin, Flavone	Antiprotozoal, Antifungal, Antibacterial, Antiallergic, Analgesic, Anticancer, Anticonvulsive
Ashwattha (<i>Ficus religiosa</i>)	Sterols, β -sitosterols Coumarins, Tannins Aminoacids, Vit K, Aliphatic alcohols	Antiulcer, Antiprotozoal, Antiviral, Anthelminthic, Antidiarrhoeal

and all have been followed up to record clinical or subclinical (by blood tests for liver functions etc.) or long term side effects.

Drug interactions indeed must have been considered by the ancient physicians but due to lack of documentation currently there seem to be no set rules for concomitant therapy.

From our experience on drug interactions with contraceptive steroids (**Joshi JV, 1985**), we believe there is a need to study this aspect and both beneficial or harmful interactions may be detected with proper studies. In a study of an oral antidiabetic formulation where we studied metformin levels with or without an Ayurvedic formulation we observed that metformin levels were reduced when the formulation was given along with metformin in the form of *choorna* rather than a tablet (Unpublished work). There is great

need to consider the possibility of interactions when Ayurvedic preparations are prescribed with Allopathic drugs for common conditions like diabetes, hypertension etc. which are common in women with dysfunctional bleeding or menorrhagia.

There is however less need to be worried about the implications as the side effects of Ayurvedic preparations should be automatically compared with the long lists of possible effects in most common Allopathic drugs, and most Ayurvedic drugs are relatively safe.

However proper instructions will warn and guard patients against self medication, drug interactions etc.

Drug delivery systems

In Ayurveda various dosage forms and drug delivery systems have been described e.g.

Table 3. Ayurvedic properties of medicinal plants used in the treatment of menorrhagia.

Name of Plant	Kula	Guna	Rasa	Veerya	Vipaka	Doshaghna
Ashoka (<i>Saraca asoka</i>)	Shimbi	Laghu Ruksha	Kashaya Tikta	Sheeta	Katu	Dosha - Kaphapittaghna Dhatu-Rasa, Rakta, Meda Mala, Purisha, Mutra Organs-Uterus
Lodhra (<i>Symplocos racemosa</i> Roxb)	Lodhra	Ruksha Laghu	Kashaya	Sheeta	Katu	Dosha-Kaphapittaghna Dhatu-Rakta Mala-Purisha Organs-Eyes, Uterus
Amalaki (<i>Embilica officinale</i>)	Eranda	Laghu, Ruksha Sheeta	Pancha- rasa except Lavana	Atisheeta	Madhur	Dosha-Pittaghna, Tridosahara Dhatu- Saptadhatu, Rasayan Mala- Purisha Organs- Eyes, Liver, Spleen
Nagkesar (<i>Mesua ferrea</i> Benth Hook)	Ela	Laghu Ruksha	Kashaya Tikta	Slightly Ushna	Katu	Dosha-Kapha, Pitta, (Alleviation) Dhatu-Rakta, Majja, Shukra, Sweda Purisha, Mutra
Haridra (<i>Curcuma longa</i> Linn)	Haridra	Ruksha Laghu	Tikta Katu	Ushna	Katu	Dosha-Kaphapittaghna Dhatu-Rasa, Rakta, Meda, Mala-Vermicidal Organs- Uterus, Bladder
Japa (<i>Hibiscus rosasinensis</i>)	Japa	Laghu Sheeta	Madhura Kashaya	Sheeta	Madhur	Dosha-Tridoshaghna Dhatu- Mala- Organs- Uterus, Bladder
Vata (<i>Ficus bengalensis</i> Linn)	Vata	Guru, Ruksha	Kashaya	Sheeta	Katu	Dosha - Kaphaghna, Pittaghna Dhatu - Rakta, Skin, Shukra Mala - Purisha, Mutra (Astringent) Organs - Uterus
Lajjalulu (<i>Mimosa pudica</i>)	Shimbi	Laghu Ruksha	Kashaya, Tikta	Sheeta	Katu	Dosha - Kaphaghna, Pittaghna Dhatu - Rasa, rakta, shukra Organs - Blood, Uterus

oral (*choorna, kwath, phanta, arishta, asava, vati*), rectal, vaginal, cutaneous and nasal routes of drug delivery (**Charak, Sushrut, Sharangdhar, Bhava Mishra**).

It is time to study these in a form that is acceptable and safe for the patients. The current modes of administration by conventional *uttarbasti, pichu, kalka* or *dhavan* by *kwath* are tedious, and require the preparation of fresh materials. Their daily doses are likely to be variable and shelf life is short.

The Allopathic science has made great strides in this field of drug delivery systems and pharmaceuticals and the kinetics, dynamics and drug interactions have been studied. The vaginal delivery system has been an acceptable and effective method for steroids and microbicides (**Hussain, Joshi 1985, Joshi and Vaidya 1997, Neves, Merabet**).

In clinical practice women accept local treatment with cream or pessary as it is easy to be used. The development of new delivery

Table 4. Phytochemical and Pharmacological properties of common medicinal plants used in the treatment of menorrhagia.

Name	Phytoconstituents	Pharmacology
Ashoka (<i>Saraca asoka</i>)	Glycosides, Sterols, Tannins, Calechor Octacosanol, Epicalchin, Procyanidin, Catechin, Glucosides, Leucocyacidine, B-Sitosterol, Quercetin, Kaempferol, Epigenin	Spasmogenic, Oxytocic, Uterotonic Antibacterial Anti-implantation, Anticancer Anti-progagation, Anti-oestrogenic Anti-menorrhagic, Antidepressant.
Lodhra (<i>Symplocos racemosa</i>)	Triterpenes-acetyloleaholic acid, oleasnic acid. Flavonoids & anthocyanins 3-Monoglucoside of 7-O-methyl leucopelargouidiu, Tannins Ellagic acid Alkaloids – loturine, colloturine	Antimicrobial activity, Antifibrinolytic, Antispasmodic- both pregnant & non pregnant uteri.
Amalaki (<i>Emblia officinalis</i> G)	Polyphenols, Gallic acid, Phyllembin, Ellagic acid, Quercetin, Ascorbic acid, Cytokinins- zeatin, Arachidic acid	Hypolipidemic, Antiviral, Immunomodulatory, Antimicrobial, Antioxidant, Anticytotoxic, Hepatoprotective, Antidyspepsia.
Nagkesar (<i>Mesua ferrea</i> Linn)	Mammeisin, fatty acids, Triterpene-guttiferol, Ferroxanthone derivatives essential oil	Antibacterial, Antifungal, Antihelminthic, Hypotensive, Antispasmodic, Antianaphylatic, Antiasthmatic, Anti-implantation, Anti-inflammatory, Juvenomimetic, Insecticidal.
Haridra (<i>Curcuma longa</i> Linn)	Curcumin I, II, III, Turmerin Diaryl heptanoids, Turmerone Aur-turmerone, Zingiberone, Cineole d – phellandrene, d – sabinene Borneol, allantone, Sesquiterpenes	Digestive, Antipyretic, Complexion, Skin diseases, Joint diseases, Anticancer, Antihaemorrhagic, Wound healing, Worms, Analgesic, Dysmenorrhoea, Asthma, Burning sensation, Liver disease Swelling, Anaemia, Diabetes.
Japa (<i>Hibiscus rosasinesis</i>)	Cyanidin diglycoside, beta-sitosterol, quercetin, calcium oxalate, hentriacontane, ascorbic acid, flavonoids	Antimenorrhagic, Antifertility, Antiestrogenic, Anticonvulsive.
Vata (<i>Ficus bengalensis</i> Linn)	Glycosides, Tannins, Triterpenes, beta-sterol, other sterols	Antihemorrhagic, Bactericidal Anti-inflammatory.
Lajjalu (<i>Mimosa pudica</i>)	phytohormones-turgorines (derivatives of 4-O-(β-D- glucopyranosyl-6-sulphate), gallic acid, calcium oxalate crystals. Mimosine, tannins, calcium oxalate, adrenaline like substance, crocetin dimethyl ester, a mucilage composed of d - xylose and d -glucuronic acid, tubulin,	Regeneration of haem, Analgesia, Anti-inflammatory, Muscle relaxant, Antispasmodic, Menorrhagia, Dysentery with blood and mucus, Piles.

systems and investigation of their efficacy, side effects, shelf life and drug interactions opens up new vistas of research in Ayurveda.

Conclusion

In spite of effective remedies listed in texts, the plant extracts and decoctions have been bitter or unpleasant and poor compliance has been a major problem for good results. Thanks to the advances in physics, chemistry and extraction procedures, the new Ayurvedic formulations are more standardized, less bulky to ingest and more acceptable for the patients. There are also some publications on research methodology by Ayurvedic physicians (**Ranade and Patwardhan, Joshi N G**), which can help in this quest for more rational formulations of common medical conditions. It is necessary that the selection of Ayurvedic medicines is based on therapeutic results from standardized preparations: i.e. Evidence Based Ayurveda (**Vaidya ABV and Raut**).

A correlation of Ayurvedic properties, phytochemistry and pharmacological evidence will help making rational and standardized formulations from Ayurvedic plants available for the treatment of leucorrhoea and menorrhagia.

With the new requirements by the Drug Regulatory Agencies of evidence based Ayurveda and compliance for standardization of plant products required from pharmaceutical companies (**FDA, Lavekar GS, Dubey GP et al. and Ayurvedic Pharmacopoea**) it becomes necessary that fewer but effective plants are included in Ayurvedic formulations. This will have the following advantages:

- i) Less drugging of the patients.
- ii) The cost for the patients will be reduced.
- iii) Consumers will be assured of good quality products.

iv) The pharma company will also find it easier to provide standardized products with upto 10 plants or less.

v) Less chance of drug interactions.

vi) More efficacy as fewer preparations will be used with specific indications as per *doshaprakopa* and *prakriti* upholding the principles of Ayurveda.

vii) Ecopreservation with lesser destruction of plants.

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