Therapeutic potentials of medicinal plants traditionally used during postpartum period and their molecular targets

Neelam Jain, Varsha Sharma and Kishan G. Ramawat*

Laboratory of Bio-Molecular Technology, Department of Botany, M. L. Sukhadia University, Udaipur-313001, India

Abstract
Childbirth is a critical period of life and behavior towards childbirth varies from culture to culture. In many Southeast Asian cultures, postpartum period is considered important from point of view of recovery by offering a period of confinement. This study aimed to describe the plants used in diet therapy after childbirth in postpartum period, their importance and tried to assess the potential effects of the practices on the health of new mother and baby. The study shows that medicinal plants play a significant role in the recovery of new mother as they possess many biological properties and their molecular targets cover vast area. Therefore, the above mentioned plant species should be further explored for their other pharmacological characteristics for human welfare. Formulations can be prepared using these plants for the better healthcare of women.

Keywords: Childbirth . Postpartum period . Diet therapy. Medicinal plants

INTRODUCTION
Childbirth is one of the most important events in the life of a woman. It is a time of transition and social celebration in many societies, signaling an adjustment of cultural responsibilities (Steinberg, 1996). In any society, childbirth is a critical period of life and behavior towards childbirth varies from culture to culture (Marshall, 1985). In Indian and Chinese societies, herbal medicines are available for small maladies like cuts and burns to major ailments like tumors and wounds. Therefore, it is but natural that herbal preparations are developed for an important event like childbirth in the society. Traditionally, people have a rich knowledge of herbs which are related to childbirth and affect fertility, pregnancy, parturition and postnatal period (Newman, 1985). In many Southeast Asian cultures, postpartum period is considered important from point of view of recovery by offering a period of confinement ranging from 10 to 45 days. The postpartum period (recovering women’s health after delivery) is broadly defined as beginning 1 hour after delivery of the placenta and lasting 6 weeks (Blenning and Paladine, 2005). The World Health Organization, 2006 recognizes that this is in keeping with traditional practices of many cultures where a 40 day period of extra support is provided for the new mother and her baby. Although little evidences are present to support the timing and content of the postpartum visit (Gunn et al., 1998), yet there is evidence that this is a time of increased health needs for both mother and baby. According to humoral medicine, pregnancy is seen as a hot state; with parturition heat is lost and the woman comes into a state of excess cold, and during the postpartum period, care should be taken to restore the mother to equilibrium (Roasting 2003). Accordingly, postpartum care is aimed at keeping the new mother warm; it is believed that this will restore her humoral balance.

The common health problems to new mother during first 6–7 months postpartum are tiredness/exhaustion, backache, pain in perineum or lower uterine caesarean section (LUCS), wound, sexual problems, hemorrhoids, relationship with partner, bowel problems, urinary incontinence, contraception, more upper respiratory tract infections (URTI) than usual and mastitis (Piejko, 2006).

Confinement is to protect the new mother and her infant from exposure to illness, because both are considered to be in a vulnerable state after birth (Kim-Godwin, 2003). It, as a treatment involves, staying inside the home, avoiding housework, proper hygiene, proper nutrition, eating hot food, avoiding cold food, abstaining from sexual activity etc. Indian traditions offer a detailed therapeutic course line for postpartum care of the mother so that her physiology can be completely rejuvenated by following simple house hold nutrition to strengthen the mind and body. These diet therapies are traditionally known to prevent disorders such as depression, insomnia and indigestion etc. Indian system of medicine also mentioned special life style and food habits for puerperal women up to 45 days after delivery.

Medicinal plants have a significant role during pregnancy, birth and postpartum care in many parts of the world. Graphical representation of importance of medicinal plants during postpartum period is presented in Figure 1. Erosion and deterioration of traditional medical knowledge can be observed in many cultures and lead not only to a loss in biocultural diversity, but also diversity in alternatives for primary healthcare (Maffi 2005). This paper describes the plants used in diet therapy after childbirth, their importance and tries to assess the potential effects of the practices on the health of new mother and baby from a western health perspective.
**Key messages**

- Postpartum diet therapy have shown positive effects on maternal health as well as on the health of newborn as bioactive principles pass from mother to baby through lactation.
- Our study on these medicinal plants (Jain et al., 2011) has found that most of the plants possess potent antioxidant activity, thus exert many beneficial effects on the health of mother and baby.
- Further investigation is needed to explore other important pharmacological properties of these medicinal plants.

**METHOD**

This study was carried out at urban and rural sites in Rajasthan which is the largest state in India and is located in the northwestern part of the country. The Aravalli hills divide the state of Rajasthan into two geographically and culturally different parts: north-western desert, and south-eastern hilly semi-arid forest.

Information was collected by interviewing several informants and midwives who had a detailed knowledge of plant use. There are specialized shops who sell such herbal products were also consulted. For botanical confirmation, all plant specimens were directly collected in the field and identification was done at Department of Botany, Mohanlal Sukhadia University, Udaipur.

**Life style and dietary pattern during postpartum**

**Behavioral restrictions**

In India, the 42 day restrictions after childbirth is considered as resting period, which may sometimes lasts up to 60 days. During this period, family members (especially female relatives) provide strong social support; help new mothers at home during that period strictly limiting her activities, and her needs are taken care of by female relatives and midwives as in other non-western cultures (Kim-Godwin, 2003). Postpartum women are traditionally advised to follow a special dietary and lifestyle pattern, which is quite different from the dietary and lifestyle patterns they maintain before and after postpartum period as in China (Liu et al., 2006). According to Ayurveda, after birth, the vata dosha (one of the three balancing aspects) is likely to increase. This may increase levels of anxiety or confusion, disturbance in sleep (even when not woken by baby), lack of energy, feeling the cold more than usual, aching joints, lack of routine including for mealtimes, restlessness, skin and hair dryness, brittle nails, digestive disturbance especially more gas and/or constipation. Ayurveda recommends regular massage (or self-massage) for raised levels of vata, to improve mood and to reduce skin dryness. Therefore, daily massages with warm oil are also given to both mother and baby.

The women wear long clothes or woolen clothes, socks and scarf and completely cover their body to keep it warm. They are prohibited to take bathe or wash hair in this period. Cold baths or showers are avoided. It is believed that as the postpartum woman is weak, water can harm skin by causing body swelling, body ache and cold which can be passed to the baby. Similarly, hair washing will cause a headache. It is believed that if a woman does not follow these restrictions, she may suffer a poor health at her later life.

**Diet therapy**

The emphasis is given on proper nutrition during postpartum time. Avoidance of foods classified as cold, such as fresh fruits and vegetables, cold foods, and plain water, is almost universal (Boer and Lamxay, 2009). Special preparations of herbs and spices, a good amount (15-20 L) of ghee (cleared butter) and dry fruits are given to the new mother during this period. The consumption of milk, butter and cleared butter is encouraged due to the belief that these foods will increase the quantity and quality of breast milk along with help to overcome weakness and regain body strength. A tea spoonful powder of long pepper (Piper longum) is given daily to the mother for stimulating both digestive and respiratory system. It also adds thermogenic response.

A sweet preparation made of caraway or carom seeds (Trachyspermum ammi) is given for initial 5 to 7 days to the new mother for cleaning of uterus and to avoid stomach problems. The powdered seeds are cooked with cleared butter and sugar and taken regularly after delivery for 5-7 days in early morning.
After that, a sweet preparation or dessert made of dried rhizome of ginger (Zingiber officinale) in cleared butter and sugar is given for next 3 to 5 days to avoid gastrointestinal disorders. Ginger enhances absorption and prevents gastrointestinal side effects.

Then, a preparation named “Battissa” (meaning 32) made by mixing about 32 herbs namely Embelia ribes, Rubia cordifolia, Mesua ferrea, Elettaria cardamomum, Areca catechu, Curcuma amada, Piper cubeba, Piper nigrum, Piper longum, Asparagus racemosus, Quercus infectoria, Tribulus terrestris, Terminalia chebula, Mucuna pruriens, Cocos nucifera, Cinnaomonum zeylanicum, Butea monosperma, Anethum graveolens, Curculigo orchioides, Curcuma longa, Desmodium gangeticum, Gmelina arborea, Litsea glutinosa, Osmicium baccilicum, Smilax chinesis, Solanum suratense, Solanum indicum, Syzigium aromaticum, Vitex negundo etc. is given for about 7 days to cure various common disorders of this period such as body pain, swelling, abdominal and uterine pain, excessive bleeding, weakness etc. and as tonic.

After that, a preparation made of Box myrtle (Myrica esculenta) in cleared butter is given to the new mother in order to relieve her from any sort of depression and headache. The plant possesses anxiolytic and antidepressant activity.

Up to these period, hot herbal preparations in nature (all the above mentioned preparations) along with meal is given to the mother to recover from the cold state and for cleaning of the uterus. Now, food which exerts cold effect is given for balancing.

A food preparation made of Symplocos racemosus is given for 3 to 5 days to cure hormonal imbalance, excessive bleeding, leucorrhea etc. Then, Anogeissus latifolia preparation including cleared butter, dry fruits and jaggery, in the form of dessert is given to the mother for wound healing, to cure body ache especially back pain. The complete diet chart of the postpartum period is given in Table 1.

### Table 1. Diet chart during postpartum period

<table>
<thead>
<tr>
<th>Days of administration</th>
<th>Food preparation</th>
<th>Possible health benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 3-5 days</td>
<td>&quot;Ajkain&quot; sweet preparation made of seeds of Trachyspermum ammi with cleared butter, sugar and dry fruits</td>
<td>To cure stomachache, gas trouble and for cleaning of uterus</td>
</tr>
<tr>
<td>3-5 days</td>
<td>Zinger sweet preparation made of Zingiber officinale with cleared butter, sugar and dry fruits</td>
<td>To improve digestion, alleviate gastrointestinal problems and uterine cleaning</td>
</tr>
<tr>
<td>About 7 days</td>
<td>A preparation named &quot;Battissa&quot; containing about 30 herbs</td>
<td>For strength and rejuvenation and to cure body and back pain</td>
</tr>
<tr>
<td>3 days</td>
<td>&quot;Kaiphal&quot; preparation made by the bark of Myrica esculenta</td>
<td>Cure headache, depression and exerts soothing effect</td>
</tr>
<tr>
<td>5-7 days</td>
<td>&quot;Lodh&quot; made by Symplocos racemosus in cleared butter and sugar</td>
<td>To cure hormonal imbalance and check excessive bleeding</td>
</tr>
<tr>
<td>3 days</td>
<td>Almonds (Prunus amygdalus)</td>
<td>For strength</td>
</tr>
<tr>
<td>7 days</td>
<td>Gum obtained from Anogeissus latifolia with cleared butter and jaggery</td>
<td>To cure backache and provide strength</td>
</tr>
</tbody>
</table>

### Biological properties of plants used during postpartum period

The plants used during postpartum period possess diverse pharmacological properties which help the new mother to recover and to strengthen health of new born also. These medicinal plants are used in combination and thus some plants act as bioenhancer as well as immunomodulator. Bioenhancer are drug facilitators, they are the molecules which themselves do not show typical drug activity but when used in combination enhance the activity of drug molecules. In Indian system of medicine, combination of plants is used rather than using single plant; hence preparations having combination of plants play an important role in modulating drug effect, e.g., piperine from Piper species acts as bioenhancer (Atal et al., 1981).

Aegle marmelos contains diverse molecules such as essential oils, coumarins, furoquinoline, alkaloids, triterpenoids, tannins and sterols etc. This is one of the ingredients of Dasmoolarish (ten roots, a standard Ayurvedic medicine for loss of appetite and inflammations of uterus). Seeds of Anethum graveolens are used as household remedy to relieve digestive problems such as stomachache, indigestion and flatulence. Dill water is believed to have a soothing effect and is given to babies to treat grippe, relieve hiccups and colic. It is also a galactogogue. Seeds are chewed by women after delivery to digest food and to increase secretion of milk (Jain et al., 2005). Some of these properties of the plant have been validated scientifically. Similarly, gum of Anogeissus latifolia is given to the lady after delivery to get rid of back pain and to repair damaged tissue (Jain et al., 2005). Gum of this plant is also used as tonic and galactogogue. Gum of Butea monosperma accelerates wound healing (Sumitraa et al., 2005), imparts bone biomechanical strength (Bhargavan et al., 2009) and possesses osteogenic activity (Maurya et al., 2009). As per the need of the period, female rejuvenators are also fed to the new mother to supply female hormones and to maintain urinary tract and strengthen the immune system. Asparagus racemosus perform these actions and it is also a galactogogue.

Cinnamomum zeylanicum is used in uterine hemorrhage, stomachache, as an antiseptic and an astringent (Jayaprakash et al., 2003). The scientific trials have confirmed its immunomodulatory activity. Elettaria cardamomum is used in Ayurvedic and Unani system of medicine against gastrointestinal disorders, cardiac disorders, renal and vesicular calculi, dyspepsia, debility, anorexia, asthma, bronchitis and halitosis (The wealth of India, 2005). The formulation made by cardamom is given along with other ingredients to the mother after 15 days of delivery in early morning as it is very effective against urinary problems, strengthening mother’s body after delivery, remove stomach pain, avoid excess bleeding, etc. (Rajith et al., 2010).

Embelin is the main bioactive molecule of the plant Embelia ribes. It is a powerful antihyperlipidemic agent and lower blood glucose levels and blood pressure (Bhandari et al., 2008). Piper longum is highly valued in Ayurveda for treating several disorders...
mostly related to indigestion, fever, asthma and cough (Dev, 2006). Piperine, the main bioactive molecule of this plant enhances the thermo genesis of lipid and accelerates energy metabolism in the body (Malini et al., 1999) and also increases the serotonin and beta-endorphin production in brain. It also acts as immunomodulator, bioenhancer and digestive stimulant. *Symplocos racemosa* is used in Ayurveda for various female disorders. It is astringent, cold and used in menorrhagea, metrorrhagea, leucorrhoea, blood disorders, for wound healing and to stop hemorrhage. Figure 2 shows bioactive principles of the medicinal plants used in postpartum period and Figure 3 contains pictures of medicinal plants.

Many of the plants used in postpartum period possess high total phenolic content and are potent antioxidants (Jain et al., 2011) which may have many indirect beneficial pharmacological actions.

**Molecular targets**

Nuclear factor-κB (NF-κB) pathway activation is common to both inflammation and cell proliferation (cancer). It regulates several genes associated with inflammation, proliferation, carcinogenesis and apoptosis.
Curcumin from *Curcuma* species possesses anti-inflammatory and anticancer properties. Curcumin suppresses prostaglandin synthesis by effecting cyclooxygenase (COX), a key enzyme responsible for the conversion of arachidonic acid to prostaglandins. It has also been shown to suppress the production of cytokines such as interferon-γ (IFN-γ), interleukins and tumor necrosis factor (TNF), inhibit the inducible nitric oxide synthase (iNOS); and to suppress the activation of NF-κB. These pathways affected by curcumin, not only play an important role in inflammation; they have also been associated with the development and progression of cancer (Aggarwal et al., 2006) and references therein.

Piperine from *Piper* species has been shown to be a bioenhancing principle for many bioactive molecules. It inhibits the major drug-metabolizing enzyme CYP3A4 and the drug transporter P-glycoprotein (Bhardwaj et al., 2002). Embelin is a potent inhibitor of transcription factors NF-κB activation, which makes it a potentially effective suppressor of tumor cell survival, proliferation, invasion, angiogenesis, and inflammation (Ahn et al., 2007). *A. racemosus* contains several glycosides, and one of these, shatavarain-I has been shown to block oxytocin-induced contractions in rat, guinea pig, and rabbit uteri *in vivo* and *in situ* (Gaitunde and Jetmalani, 1969). In postpartum and estrogen primed rate, intramuscular injection of the alcoholic extract of the roots was shown to exert lactogenic effect, increasing milk yield and breast lobular-alveolar tissue which has been attributed to an increase of prolactin levels or to a release of corticosteroids (Sabnis et al., 1968).

Scoparone and scopalatin is the chemical constituent of *Aegle marmelos* responsible for various anti-inflammatory purposes. Apigenin, luteolin and herniantocantanol from *Gmelina arborea* show anti-inflammatory activity. *Terminalia chebula* and *Litsea glutinosa* are potent angiotensin-converting enzyme (ACE) inhibitors; hence they possess antihypertensive action (Dev, 2006). ACE inhibitors are also used as therapeutic agents in many other diseases, especially originating from hypertension, such as heart failure, stroke etc. Molecular targets of postpartum diet plants are presented in Table 2.

Table 2 presents the information about the plants used in postpartum healthcare in India such as common name, part used and scientific validations of the medicinal properties.

<table>
<thead>
<tr>
<th>Plant name</th>
<th>Bioactive molecules</th>
<th>Molecular target</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aegle marmelos</em> (Rutaceae)</td>
<td>Scoparone, scopalatin</td>
<td>↓ NO, ↓ COX-2, ↓ iNOS, ↓ cyclin D1, ↓ TNF, ↓ IL-6, ↓ IL-12</td>
</tr>
<tr>
<td><em>Tribulus terrestris</em></td>
<td>Steroidal saponins</td>
<td>↓ NF-xB, ↓ cyclin D1, ↓ COX-2, ↓ iNOS, ↓ TNF, ↓ IL-6, ↓ IL-12</td>
</tr>
<tr>
<td><em>Curcuma longa</em></td>
<td>Curcumin</td>
<td>↓ NF-xB, ↓ cyclin D1, ↓ COX-2, ↓ iNOS, ↓ TNF, ↓ IL-6, ↓ IL-12</td>
</tr>
<tr>
<td><em>Piper longum</em></td>
<td>Piperine</td>
<td>Drug-metabolizing enzyme CYP3A4</td>
</tr>
<tr>
<td><em>Emblica ribes</em></td>
<td>Embelin</td>
<td>↓ NF-xB</td>
</tr>
<tr>
<td><em>Gmelina arborea</em></td>
<td>Apigenin, luteolin, Herniantocalton</td>
<td>↓ COX-2, ↓ cyclin D1, ↓ IL-4, ↓ IL-13, ↓ NF-xB</td>
</tr>
<tr>
<td><em>Terminalia chebula</em></td>
<td>Ellagic acid, chebulin</td>
<td>Antioxidant, converting enzyme (ACE)</td>
</tr>
<tr>
<td><em>Litsea glutinosa</em></td>
<td>Boldsine</td>
<td>Antioxidant, converting enzyme (ACE)</td>
</tr>
<tr>
<td><em>Asparagus racemosus</em></td>
<td>Glycosides</td>
<td>↑ Prolactin, ↑ corticosteroids</td>
</tr>
</tbody>
</table>

Table 3. Information about the plants used in postpartum healthcare in India

<table>
<thead>
<tr>
<th>Plant name</th>
<th>Local name</th>
<th>Part used</th>
<th>Scientifically validated pharmacological properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aegle marmelos</em> (Rutaceae)</td>
<td>Bael, Bilva</td>
<td>Fruits</td>
<td>Antioxidant, hepatoprotective, antihypertipidemic</td>
</tr>
<tr>
<td><em>Anethum graveolens</em> (Apiaceae)</td>
<td>Dhawra, Sowa</td>
<td>Fruits</td>
<td>Galactogogue, antihypertipidaemic, antihypercholesterolemic, antioxidant, antispasmodic, regulatory agent of the menstrual cycle</td>
</tr>
<tr>
<td><em>Anogeissus latifolia</em> (Combretaceae)</td>
<td>Dhawra, Bakli</td>
<td>Gum</td>
<td>Cure backpain and to repair damaged tissue, hepatoprotective, wound healing potential, antioxidant</td>
</tr>
<tr>
<td><em>Areca catechu</em> (Arecaceae)</td>
<td>Supari</td>
<td>Seeds, nut</td>
<td>Treatment of medication-induced movement disorders</td>
</tr>
<tr>
<td><em>Asparagus racemosus</em> (Asparagaceae)</td>
<td>Shatavari, Safavar</td>
<td>Roots</td>
<td>Female rejuvenative, Blood purifier, Immunostimulant, immunoaudvant, tonic, antidepressant, adaptogen, galactogogue, treatment of gastric ulcers and dyspepsia,</td>
</tr>
<tr>
<td><em>Butea monosperma</em> (Fabaceae)</td>
<td>Kamarkas, Palas, Tesu, Khakara</td>
<td>Gum</td>
<td>Impart bone biomechanical strength, osteogenic activity</td>
</tr>
<tr>
<td><em>Cinnamomum Zeylanicum</em> (Lauraceae)</td>
<td>Dalchini, Twak</td>
<td>Bark</td>
<td>Immunomodulatory activity</td>
</tr>
<tr>
<td><em>Cocos nucifera</em> (Arecaceae)</td>
<td>Khopra, Nariyal</td>
<td>Endosperm</td>
<td>Antinoiceptive and antioxidant</td>
</tr>
<tr>
<td><em>Curculigo orthoides</em> (Hypoxidaceae)</td>
<td>Kali musli</td>
<td>Tubers</td>
<td>Metabolic enhancer, tonic, galactogogue, possesses estrogenic activity</td>
</tr>
<tr>
<td><em>Curcuma amada</em> (Zingiberaceae)</td>
<td>Amba-haldi</td>
<td>Rhizome</td>
<td>Treatment of dysentery and body ache, antioxidant, anti-hypercholesterolemic</td>
</tr>
<tr>
<td><em>Curcuma longa</em> (Zingiberaeaceae)</td>
<td>Haldi</td>
<td>Rhizome</td>
<td>Antioxidant, atherosclerotic, for wound healing and gastrointestinal disorders</td>
</tr>
<tr>
<td><em>Desmodium gangeticum</em></td>
<td>Shala panni</td>
<td>Roots</td>
<td>Antioxidant, anti-inflammatory and antidiabetic</td>
</tr>
</tbody>
</table>
DISCUSSION

The postpartum period is a time of tremendous changes, increased health problems, and emotional upheaval for new parents. Both mother and child are considered to be in a vulnerable state after birth. Confinement is practiced to protect mother and infant from exposure to diseases. Plants used during postpartum recovery are more common but no specific plant or plant extracts are used during pregnancy or to facilitate childbirth. The plants are not used for the purpose of bath in India as in other societies such as the use of Bakera in Indonesia (Zumsteg and Weckerle 2007), the Temazcal in parts of Mexico (Castaneda Carney et al, 1996) and herbal bath in Guatemala (Michel et al., 2006). The concept of Steam bath and herbal bath in Ayurveda, and herbal bath in Indian traditional society, have a significant role in postnatal recovery. The above mentioned plant species should be explored for their pharmacological characteristics for human welfare. Formulations can be prepared using these plants.

ACKNOWLEDGEMENTS

This work was supported by financial assistance from UGC-DRS under special assistance programme for medicinal plant research to K.G.R. N.J. and V.S. thanks UGC for financial assistance in the form of fellowship.
REFERENCES


