



INTERDISCIPLINARY PERSPECTIVE OF LAGHUMALINI VASANT AN AYURVEDIC FORMULATION TOWARDS THERAPEUTIC POTENTIAL IN ANTENATAL CARE

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ARTICLE INFO

Received:

09 Mar 2023

Received in revised form:

19 May 2023

Accepted:

02 Jun 2023

Available online:

28 Jun 2023

Keywords: *Laghumalini vasant Ras*, Zinc oxide, Maternal health, Fetal growth

ABSTRACT

Laghumalini vasant ras (LMV) is a herbomineral formulation mentioned for treating fever in pregnant women and is also claimed effective for fetal growth. *Laghumalini Vasant Ras* (LMV) is a zinc formulation mentioned in Yogartnaka. Many herbal and herbomineral formulations are mentioned as antioxidants and immunomodulatory. One of the formulations mentioned is *Laghumalini Vasant*. The present article is planned to compile the available literature regarding the pharmacological properties of the drug used in LMV and an effort has been made to explore the efficacy of LMV in Antenatal Care. Because of modern pharmacotherapeutics, LMV can be claimed to have applicability in treating the diseases of mothers and promoting normal fetal growth and development. The related data were collected from Ayurvedic texts, Journals, modern books, and e-materials available. A review of LMV explores the individual drug efficacy and its cumulative effect of them. Zinc oxide, *Piper nigrum* Linn, raw butter, and lemon juice individually are having significance in antenatal care. LMV is beneficial in maternal health care during pregnancy and the normal growth of the fetus. It is a possibility that LMV will prevent complications during pregnancy. However, it can be recommended for normal fetal growth during gestation.

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To Cite This Article: Wanjari AS, Rathi BJ, Wanjari DS, Gokarn RA. Interdisciplinary Perspective of *Laghumalini Vasant* an Ayurvedic Formulation Towards Therapeutic Potential in Antenatal Care. *Pharmacophore*. 2023;14(3):71-7. <https://doi.org/10.51847/5FPPJrflI5>

Introduction

The utilization of metals, and minerals for therapeutic purposes in the form of *Bhasma* (incinerated ash) is found to be before the 3rd century A. D. [1]. The books on Rasa-shastra are *Rasa Ratnasamuchaya*, *Rasatarangini*, *Rasayoga sagar*, *Rasendra Sara sangraha*, *Bhaishajya Ratnavali*, etc. were mostly composed during the 8th century and thereafter [2]. The use of metallic preparations in healthcare is a unique feature of this system [3, 4]. In due course of time, herbs minerals, and herbo metallic preparations occupy their place in *Ayurvedic* pharmacopeia and used in India for many centuries [5, 6]. Processed metals like Mercury, Gold, silver, bronze, Iron, Zinc, etc. were used in different disease conditions with great authority from the 8th century onward [7, 8]. Metals like Gold, Silver, Iron, Copper, Zinc, Lead, and Tin as well as some alloys were used to treat diseased conditions after proper processing [9].

The use of zinc in oral and topical applications after proper processing was in practice since the 14th century A.D. Zinc ore like zinc carbonate, zinc metal, zinc oxide, and brass are used as therapeutic agents in Ayurveda [10, 11]. In major compendia of Ayurveda, there is no therapeutic reference to zinc [12, 13]. But the reference of an alloy zinc i.e. brass can be found [14].

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Laghumalini Vasant Ras (LMV) is a zinc formulation mentioned in Yogratnakar. Yogratanakar is a renowned treatise from Indian medicines. It contains information on Indian medicine from ancient times to the later part of the 17th century AD. Yogratanakar is a collection of formulations. It is compiled work related to pharmaceutical preparation and is found to be very useful in medicine preparation [15]. LMV is a formulation containing minerals and herbs. The mixture is potentiated with animal source which is raw butter followed by lemon juice. LMV comes under the category of *Kharaliya Rasayan* that which is prepared in mortar and pestle by the process of trituration. By the process of trituration on processed metals and minerals (in the form of *bhasma*), along with specific media for levigation, the inorganic material gets converted into such a form that can be acceptable by the body [16, 17]. The different pharmaceutical processes result in the target-specific action of the drug. In this formulation zinc carbonate and *Piper longum* Linn are the basic ingredients. Due to in availability of zinc carbonate, zinc oxide is used. The mixture should be levigated with freshly prepared raw butter followed by lemon juice. LMV is indicated in chronic febrile condition & the diseased condition is attributed due to *Rakta dhatu* (blood-related diseases). It is indicated in Leucorrhoea, Piles, and Ophthalmic diseases. It is stated that it is useful in pediatric diseases. LMV when given along with the juice of flowers of *Sesbania sesban* Linn in ANC condition not only conquers all types of fever but also nourishes the embryo. LMV is indicated in fever. However, apart from curing the disease condition, it is mentioned in the verse that it is having a promotive effect on fetal growth [18].

In this paper, an attempt to explore the efficacy of LMV in antenatal care is taken. The relation between maternal zinc level and fetal development is discussed. Add on the effect of *P. nigrum* Linn along with raw butter and lemon juice in LMV is also detailed.

Materials and Methods

The related literature was collected to explore LMV and the ingredients of LMV with their therapeutic efficacy given antenatal care. The search was done from various Ayurveda, textbooks of Ayurveda. The associated data was composed of various sites such as Google Scholar, Medscape, BMC Medicine, MEDLINE database, and ScopeMed.

Observation and Results

Information about LMV and the ingredients present in the formulation is collected from suitable resources. In Ayurvedic treatise, 4 formulations are mentioned under the head of *Vasant kalpas* (formulations) in the text Yogratanakar as depicted in **Table 1**. By the name of LMV two formulations are found in Yogratanakar. Both formulations have variations in ingredients and indications it is represented in **Table 1**.

Table 1. Summary of Vasant kalpas mentioned in Yogratanakar

| Name of the drug / Reference | Ingredients | Drugs Used for Processing | Dose and adjuvant | Therapeutic uses |
|------------------------------|---|---|---|--|
| Suvarna Malini Vasant | Incinerated calx of gold, incinerated form of <i>Mukta</i> , A purified form of Cinnabar | Trituration should be done with Raw butter and lemon juice | 250 mg -Along with Honey & powder of <i>P. longum</i> Linn | All types of diseases & all types of fever |
| Laghumalini Vasant (I) | Incinerated form of zinc carbonate <i>P. nigrum</i> Linn | Trituration Should be done with Raw butter and lemon juice | 250 mg -Along with Honey & powder of <i>P. longum</i> Linn But in pregnant lady, it should be given with juice of <i>sesbania sesban</i> Linn flowers | All types of fever Fever in pregnant women, children & neonates Also nourishes fetus |
| Laghumalini Vasant (II) | Zinc carbonate <i>P. nigrum</i> Linn | Levigation with human urine – 21 days Followed by Raw butter and lemon juice -101 times levigation | 250 mg Given along with honey and powder of <i>P. longum</i> Linn | Indigestion and problems associated with it |
| Apurva Malini Vasant | Incinerated calx of Tourmaline, Incinerated calx of mica, Incinerated calx of copper, Incinerated calx of copper pyrite, Incinerated calx of silver, incinerated form of Tin, Incinerated calx of coral Incinerated calx of mercury, Incinerated calx of Iron, Incinerated calx of conch shell, Borax, musk okra | Levigation should be done with infusion or decoction of <i>Vetiveria zizanoides</i> Linn, <i>Curcuma longa</i> Linn, <i>Asparagus racemosus</i> Willd | Given in a dose of 375 mg Along with <i>Guduchi satva</i> (extract of <i>Tinospora cardio folia</i> , sugar candy and Lemon juice | All types of diabetic conditions, Dysuria, renal stone, |

Here in this article on LMV which main ingredients are Zinc carbonate and *P.nigrum* Linn, and the media for trituration is butter followed by lemon juice is considered for theoretical exploration. Each ingredient in the LMV is having unique properties related to maternal health care, and fetal and neonatal development giving a cumulative effect to the formulation. The LMV as per different texts and the same ingredients with different names of formulations are mentioned in **Table 2** and Table N. The properties of ingredients are depicted in **Tables 3 and 4**.

Table 2. LMV as per different textual reference

| Sr. No. | Name | References | Findings |
|---------|------|--|---|
| 1 | LMV | Yogratnakar Jwararogadhikar Shloka 538-545 | <i>Rasakshwar ras & Rasaraj ras</i> mentiond <i>shodhana of rasaka.</i> |
| 2 | LMV | Rasatantrasar & siddha yog sangraha Prathama Khanda , Kharaliya Rasayana-34,p.185 | The author suggested using <i>Yashada Bhasma</i> as an alternative to <i>Rasaka.</i> |
| 3 | LMV | AFI Part 1(2s) part 1, Section 20 Rasayoga: 36 ;708. | It is stated that in case of unavailability of genuine rasaka, Yashad bhasma (i.e. Zinc oxide)can be used |
| 4 | LMV | Chikitsa Pradeep [19];137 | The duration of levigation with lemon juice is specified as 21 days |

Table 3. Ingredients of LMV as per different textual reference

| Sr. No. | Name | References | Remarks |
|---------|--|--|---|
| 1 | Rasak / yashad bhasma | <i>Rasaratnasamuchhaya</i> <i>Rasatarangini</i> <i>Ayurved Prakash</i> | Brings homeostasis to the body. Boost the immune system. Useful in fever, diarrhea, ophthalmic diseases |
| 2 | Maricha (<i>Piper nigrum</i> Linn) | <i>Dhanvantari nighantu</i> | Improves digestive power, improves eyesight, Cardiotonic |
| 3 | Maricha (<i>Piper nigrum</i> Linn) | <i>Sushrut Samhita</i> <i>Dhanvantari nighantu</i> | It becomes <i>samasheetoshna</i> means not hot not very cold in potency. |
| 4 | Nimbu (<i>Citrus limon</i> Linn) | Bhavprakasha | Improves the digestive power, improves eyesight |
| 5 | Navneet (Raw Butter) | Yogratnakar | It is beneficial for the pediatric and geriatric age groups. It is said that is like nectar for the children. |

Table 4. Pharmacotherapeutics efficacy of ingredients in LMV (as per research articles)

| Ingredients | Chemical constituents | Significance related to maternal health / fetal health/pharmaceutical |
|--------------------------|-----------------------|---|
| Zinc oxide | Zinc | <p>maternal & fetal health-</p> <ul style="list-style-type: none"> Deficiency of ZnO causes – Problems related to the sequencing of parturition-causing assisted delivery result in poor maternal health due to postpartum bleeding, laceration, and infection [20, 21] Problems causing efficiency with parturition- results in placental abruption, cervical dilation will be slowed, uterine contraction will be slow, causing prolonged labor, results in fetal distress. low birth weight, reduced maturity, non-term delivery, low APGAR score, stillbirth, Neonatal sepsis [22]. Placental inflammation is a normal state that occurs during every pregnancy, it needs to be controlled to prevent tissue damage that could lead to pre-eclampsia (PE), premature birth, and fetal development restriction (FGR). Increased levels of pro-inflammatory cytokines, such as TNF- and IL-6, are present both systemically and locally in the placenta in women with pregnancy problems [19]. Inflammation has been linked to impaired uteroplacental perfusion and inadequate spiral artery remodeling [23, 24] ZnO appears to be a viable molecule for the systemic treatment and prevention of inflammation during pregnancy due to its favorable effects in the regulation of local or systemic inflammation and immune-modulatory capabilities [25, 26]. By lowering the expression of pro-inflammatory cytokines such as IL-6, TNF-, MCP-1, and IL-8 in DEC's, ZnO was able to modify their pro-inflammatory response [27-29]. |
| <i>P. nigrum</i> Linn | Piperine | <p>Significance may be more related to a pharmaceutical preparation. Piperine helps in the bioavailability of the drug [30].</p> <p>Absorption of Zinc oxide is less, so piperine may be helpful in bioavailability enhancement of zinc oxide.</p> |

| | | |
|-------------|---|--|
| Raw butter | Activator X | Maternal & fetal growth-related significance |
| | Wulzen factor | ActivatorX- responsible for the deposition of calcium in bone rather than arteries |
| | Arachnoide acid | Wulzen factor- antistifness factor |
| | Lauric acid | Vitamin K - Vitamin K2 is essential for osteoporosis prevention and treatment, as it activates matrix gla protein and osteocalcin, which promote bone growth and maintenance. |
| Lemon juice | Citric acid, flavonoids, phenolic acids, coumarins, carboxylic acids, amino acids, and vitamins | Arachidonic acid - role in mineral absorption, maintaining brain functions |
| | | Lauric acid – antifungal agent [31, 32] |
| | | Significance may be more related to a pharmaceutical preparation. |
| | | Zinc oxide is not soluble in water or lipid. Zinc processed with citric acid makes zinc water soluble resulting in the facilitation of absorption [30] |
| | | Citric acid increased the bioaccessibility of zinc by about 40% [31]. |
| | | Citrus juice is a natural leaching agent for zinc. Citric acid's ability to speed up the dissolving of ZnO in the presence of anions. ZnO is slightly dissolved by anions when citric acid is absent. Citric acid is a three-membered carboxylic acid containing a hydroxyl group (-OH), and because the three-membered carboxylic acids differ in their degree of ionization, they can form a variety of complexes with the main metal. Citric acid helps to increase the solubility of metal ions, and as a result, it can increase bioabsorbability [32]. |

Results and Discussion

The drugs used in LMV are planned to achieve the cumulative effect. Zinc is a trace element and an important mineral for human beings [33]. Zinc is a part of metal proteins and enzymes. The function of zinc depends on metals -proteins, and enzymes with which it is related. Zinc plays an important role in the physiological processes of human beings. Suitable zinc intake is an important factor to enhance the physical growth of children, decreasing child illness, and also reduces mortality rate in developing countries. Zinc is considered a promotive factor [34]. The daily recommended dose of zinc for normal human beings is 12 mg /day, the Zn level is decreased physiologically in pregnancy. In pregnancy the recommended dose is 20-25 mg/day, the extra zinc is required for fetal growth [35]. For normal embryonic development, zinc is an important trace element. The deficiency of zinc in pregnant women results in malformation of the brain, eyes, bones, heart, and other organs in the embryo. Zinc is an important micronutrient for the development of the nervous system during gestation. Zinc-dependent enzymes are concerned with the replication of cells significant for brain growth and neurotransmission. It also involves an extra CNS metabolic process related to neurotransmission [36]. Consumption of zinc by infants and in pregnancy increases the blood volume. It decreases the serum albumin level and causes possible hormonal changes [37]. A marginal zinc intake during pregnancy may play an important role in the duration of gestation. Severe zinc deficiency during gestation results in spontaneous abortion and congenital diseased conditions like anencephaly. Moderate zinc deficiency is associated with intrauterine growth retardation and preterm delivery. Moderate deficiency of zinc is associated with complications of labor and delivery. Maternal zinc deficiency results in weakening the of several biological processes during gestation related to the mother and fetus. It is also responsible for the well-being of infants and survival in the first year of life. Zinc is having a significant role in CNS function, its deficiency in maternal condition affects neurogenic development during gestation [38-40]. The consequences related to maternal zinc deficiency affects the mother in term of poor maternal health like maternal laceration, postpartum hemorrhage, and postpartum infection. It affects fetal growth and development which results in fetal distress. The zinc deficiency consequences are observed in terms of low birth weight of the child, reduced maturity, Low APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) score, asphyxia, neonatal sepsis, and stillbirth [41-43]. Dietary ZnO supplementation appears to support endothelial cell function in the regulation of the inflammatory response. Many illnesses, including cardiometabolic disorders, appear to be characterized by disturbed Zn homeostasis, suggesting that the availability of Zn is crucial for the appropriate development and function of the immune system. Zn shortage appears to influence all components of the immune system [44]. The advantages of prenatal supplementation with a variety of micronutrients for healthy fetal growth are highlighted by evidence from clinical and epidemiological investigations. Clinical research suggests that this dietary supplement may help lower inflammatory processes at the fetomaternal interface. Zn homeostasis imbalance may affect pregnancy disorders [45].

The solubility of zinc salts is an important factor that is related to their bioavailability. It is studied that zinc Oxide and zinc carbonate are insoluble so poorly absorbed [46]. It is needed to add such an ingredient that can enhance the bioavailability of the zinc oxide. *P. nigrum* Linn is a component in LMV I. *P. nigrum* is most commonly used among spices. It has specific quality due to the alkaloid, piperine. The main active compound found in *P.nigrum* Linn is piperine (1-piperoyl piperidine) which is responsible for the bioenhancing effect [47]. The important quality of piperine is the bioavailability enhancer effect. The property is due to enzymatic drug bio-transforming reactions in the liver. Piperine also lowers lipid peroxidation in vivo and beneficially influences cellular thiol status and antioxidant enzymes. Piperine is considered an antioxidant. The bioavailability-enhancing effect of nutrients is due to the thermo nutrient action of piperine. A thermo-nutrient Bioperine increases the absorption of nutrients through thermogenesis. Piperine increases the rate of absorption of nutraceuticals like amino acids, curcumin, glucose, vit-B6, beta-carotene, and selenium [48]. The efficacy of piperine in oral bioavailability and pharmacokinetics of theophylline and propranolol revealed that there is an increase in the bioavailability of oral propranolol and theophylline [49].

Raw butter is enriched with vitamins, minerals, and antioxidants. Raw butter is a source of ActivatorX, which is responsible for the deposition of calcium in bone rather than arteries. Activator X, also known as Vitamin K is responsible for anti calcification and bone-forming processes. Low levels of vitamin K impair the activation activity of osteoblasts: Wulzen factor which is an antistress factor, and Arachidonic acid which is having a significant role in mineral absorption, and maintaining brain functions. Raw butter also contains lauric acid which is significant in the prevention of fungal infection and candida [3, 50]

Lemon juice is a source of citric acid (8%) and sugars. While lemons may seem quite acidic, lemon is a good source of an alkaline food that can help balance the pH of the body. Lemon contains potassium which is useful in normalizing blood pressure and helps in maintaining water balance in the body [4]. It contains secondary metabolites like flavonoids, phenolic acids, coumarins, carboxylic acids, amino acids, and vitamins [5, 6]. Zinc is insoluble in water or lipid media. When zinc is processed with citric acid makes zinc water soluble resulting in the facilitation of absorption [7].

Conclusion

In LMV zinc is having its role in the maintenance of maternal health during and after gestation. Maternal zinc deficiency can cause problems in parturition resulting in placental abruption, premature rupture of membranes, and nonterm labor. So, sequencing and timing will be affected. Zinc deficiency directly affects the normal results in fetal distress. Overall, zinc deficiency results in poor maternal health and poor neonatal health. Zinc plays a significant role in LMV formulation. The absorption of Zinc is very poor, so its bioavailability will be less. *P.nigrum* Linn is a bioenhancer helpful in the bioavailability enhancement of zinc. Raw butter is a source of many minerals and the constituents present in it are helpful in the deposition of minerals in the bone resulting in normal bone development. Arachidonic acid is helpful in normal brain development. Lauric acid present in raw butter keeps the mother free from fungal infection. Vitamin K present in raw butter is responsible for calcium absorption. The citric acid present in lemon juice helps in zinc absorption. Vitamin C is an antioxidant, reducing the oxidative stress on the mother. It also maintains the blood pressure of the mother. It can be stated that the cumulative effect of the ingredients of LMV is very promising. Thus, LMV can be a better option for treating the diseased condition during pregnancy and can be recommended to the mother during pregnancy to avoid complications. Further clinical evidence is needed to validate the concept.

Acknowledgments: Dr. Herlin Swer, Dr. Anjali Katore, Dr. Utkarsha.

Conflict of interest: None

Financial support: Datta Meghe Institute of Higher Education & Research, Sawangi(M), Wardha.

Ethics statement: None

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