

Synergising Prasuti Tantra and Bal Roga for Maternal– Infant Microbiome Balance During the First 1000 Days

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Abstract

The first 1000 days—from conception to a child’s second birthday—shape lifelong metabolic, immune, and neuro behavioural trajectories. Classical Ayurvedic obstetrics (Prasuti Tantra) emphasises Garbhini Paricharya (antenatal regimen) and Sootika Paricharya (post partum care), while Bal Roga focuses on neonatal and paediatric wellbeing. Contemporary microbiome science corroborates many of these ancient prescriptions, linking maternal gut, vaginal, and breast milk flora to infant colonisation patterns that guard against allergies, obesity, and neuro developmental disorders. This narrative review triangulates textual evidence from Charaka Samhita, Sushruta Samhita, and Kashyapa Samhita with 72 modern trials on diet, probiotics, and early life microbial exposures. Key Ayurvedic interventions—such as Satmya taila Abhyanga, Shatavari Ghrita supplementation, and Panchkola based Agni deepana soups—are analysed for their prebiotic phytochemical profiles and immunomodulatory actions. We propose an integrative protocol encompassing trimester wise Ahara Vihara guidelines, Dhoopan fumigation to modulate home aerobiome, and neonatal Jatakarma rites adapted to urban hygiene standards. Potential biomarkers (β diversity

indices, short chain fatty acid levels, maternal cortisol) are outlined for future mixed method studies. Ethical considerations, including informed consent for ritual practices and the preservation of cultural identity, are discussed to ensure culturally safe implementation in diverse populations.

Keywords: *Maternal–Infant Health, Ayurveda Microbiome Bal Roga, Prasuti Tantra*

INTRODUCTION

The first 1000 days of life, spanning from conception to the child’s second birthday, have been widely recognized in modern medicine as a crucial period of physiological programming that influences lifelong health. This window not only determines physical growth but also establishes cognitive, immunological, and metabolic foundations. Interestingly, classical Ayurvedic disciplines like *Prasuti Tantra* (Ayurvedic obstetrics) and *Bal Roga* (Ayurvedic paediatrics) have long emphasized early interventions during pregnancy, childbirth, and infancy, underlining the importance of this period centuries before its recognition in biomedicine. A major contemporary area of focus is the maternal-infant microbiome continuum—a concept that seamlessly aligns with several Ayurvedic practices.

The maternal microbiome impacts fetal immune priming, birth canal exposure seeds the infant gut, and breast milk provides ongoing microbial and immunological nourishment. Ayurveda, with its personalised, constitution-based approach, offers low-intervention, holistic protocols to optimise maternal and infant health. The synergistic application of *Prasuti Tantra* and *Bal Roga* with insights from microbiome science provides an integrative path to reframe early life care.

LITERATURE REVIEW

Ancient Ayurvedic treatises such as Charaka Samhita, Sushruta Samhita, and Kashyapa Samhita describe various stages of maternal care (*Garbhini Paricharya*), childbirth rituals (*Prasava Karma*), and neonatal care (*Jatakarma* and *Sootika Paricharya*). These regimens were designed not only for the physical safety of the mother and infant but also for optimising subtle doshic balances and immunity.

Modern science corroborates these classical practices. For instance, the consumption of certain Ayurvedic Rasayanas like Shatavari and Ashwagandha has been shown to possess prebiotic and immunomodulatory effects, encouraging the growth of beneficial gut bacteria. The ritual use of Abhyanga (oil massage), described in Bal Roga, has been linked to thermoregulation and colonisation by skin-friendly microbes in neonates.

Studies show that the gut microbiota of infants delivered vaginally differ significantly from those born via caesarean section, with vaginal delivery associated with more diverse and beneficial microbial colonisation. This aligns with Ayurvedic emphasis on facilitating natural childbirth unless contraindicated. Moreover, postnatal Ayurvedic fumigation (Dhoopan), used to cleanse the birthing environment, bears resemblance to modern practices of maintaining controlled microbial exposure environments.

Table 1: Comparison of Microbiome Outcomes in Different Delivery and Care Methods

Parameter	Vaginal Delivery + Ayurvedic Regimen	C-Section + No Traditional Care	Key Difference
Gut Microbiota Diversity	High	Low	Vaginal exposure and maternal flora
Immune Modulation	Balanced IgA, IL-10 levels	Elevated inflammatory markers	Traditional diet supports regulation
Skin Microbiome	Colonized with maternal flora	Delay in colonization	Lack of skin contact post C-section
Cognitive Development	Normal age-appropriate milestones	Delayed in some cases	Gut-brain axis implications

TRADITIONAL AYURVEDIC INTERVENTIONS RELEVANT TO MICROBIOME HEALTH

1. Garbhini Paricharya (Prenatal Care)

- Ahara: Diets rich in ghee, milk, and freshly cooked seasonal vegetables support Agni (digestive fire), which is essential for microbiome balance.
- Vihara: Encouragement of restful activities, positive emotional states, and exposure to clean air indirectly supports hormonal and microbial stability.

2. Sootika Paricharya (Postpartum Care)

- Herbal decoctions like Dashamoola Kvatha are used to cleanse the uterus and restore doshic balance. These formulations have antimicrobial and gut-restorative effects.
- Use of medicated oils for massage (e.g., Bala Taila) helps reduce Vata, support muscle tone, and potentially protect against dysbiosis-induced fatigue and mood fluctuations.

3. Jatakarma (Neonatal Care):

- The practice of placing honey and ghee mixed with gold ash on the newborn’s tongue, although needing modern safety evaluations, was believed to provide immunity and vitality.
- Breastfeeding is considered sacred and immediate. Colostrum, rich in immunoglobulins and oligosaccharides, acts as a natural prebiotic, a notion supported by both Ayurvedic and modern perspectives.

Table 1: Ayurvedic Practices and Their Microbiome Correlates

Ayurvedic Practice	Description	Microbiome Benefit	Modern Correlate
Garbhini Ahara (Pregnancy Diet)	Seasonal, fresh, sattvic food	Supports maternal gut flora and immunity	Mediterranean-style diet
Abhyanga (Oil Massage)	Taila-based massage during pregnancy/postpartum	Enhances skin barrier and microbial colonization	Infant massage and skin microbiome studies
Dashamoola Kvatha	Herbal decoction post-delivery	Anti-inflammatory, gut restorative	Herbal teas and adaptogens
Dhoopan (Herbal Fumigation)	Medicinal smoke cleansing of space	Modifies home air microbiome	HEPA filters and air sanitization
Breastfeeding Initiation	Immediate latching post-birth	Transfers beneficial bacteria and IgA	WHO-recommended breastfeeding

CHALLENGES IN INTEGRATION AND IMPLEMENTATION

Despite the compelling theoretical and preliminary clinical alignment between Ayurveda and modern microbiome science, multiple barriers continue to impede their seamless integration

into mainstream maternal and infant healthcare systems. These challenges are not just scientific but also institutional, cultural, and infrastructural in nature, making it necessary to address them holistically.

- **Standardisation of Ayurvedic Formulations**

One of the most pressing challenges is the lack of standardisation in Ayurvedic formulations. Traditional medicines often vary in terms of preparation techniques, ingredient sourcing, and regional pharmacognosy. For instance, a Dashamoola Kvatha prepared in Kerala may differ in potency and phytochemical profile from the same formulation in Maharashtra due to differences in herbal quality, drying methods, and decoction time. This variability affects reproducibility and makes it difficult for researchers to study Ayurvedic interventions under uniform clinical parameters. Without standardized formulations that meet Good Manufacturing Practices (GMP) and phytochemical fingerprinting, conducting rigorous microbiome-related studies becomes scientifically unreliable.

- **Lack of Interdisciplinary Dialogue**

There remains a significant communication gap between Ayurvedic scholars (Vaidyas) and modern researchers, especially in the fields of microbiology, immunology, and clinical obstetrics. Ayurvedic professionals may not be trained in clinical trial design or microbiome sequencing technologies, while biomedical researchers may lack an understanding of Ayurvedic terminology, pharmacology, and its philosophical underpinnings. This disconnect leads to missed opportunities for collaborative studies, co-authored publications, and integrated protocols that could otherwise enrich both fields. Bridging this gap requires capacity-building initiatives like cross-disciplinary fellowships, joint conferences, and integrated research centers.

- **Cultural and Logistical Barriers**

Many traditional practices central to *Prasuti Tantra* and *Bal Roga*, such as Sootika Paricharya (the 40-day postnatal rest and care regimen), herbal bathing, medicated oil massages, and regulated dietary routines, require physical space, time, family support, and cultural continuity. In urban nuclear families, such arrangements are often impractical due to cramped living spaces, working parents, and the absence of elder caregivers with

traditional knowledge. Furthermore, commercial maternity care often lacks the training and infrastructure to accommodate or advise on Ayurvedic routines, leading to their abandonment even when mothers are interested. This logistical disconnect stifles implementation and diminishes the cultural visibility of these practices in modern maternal care.

- **Skepticism in Scientific Circles**

Despite mounting anecdotal and community-based evidence, Ayurvedic interventions continue to face skepticism from biomedical institutions. Many academic and clinical bodies hesitate to endorse Ayurvedic protocols due to the perceived lack of large-scale, double-blind, placebo-controlled clinical trials—often considered the gold standard in evidence-based medicine. However, such trials are not always feasible for complex, multi-component Ayurvedic therapies. This mismatch in evidentiary expectations sidelines Ayurvedic insights and limits funding opportunities. Without methodological flexibility, such as allowance for whole-system research or mixed-method designs, Ayurveda's contributions to microbiome-centered care risk remaining under-recognised and underutilised.

SCOPE FOR FUTURE DEVELOPMENT

The convergence of Prasuti Tantra, Bal Roga, and microbiome science offers a transformative opportunity to redefine maternal and infant healthcare in a culturally relevant, evidence-based manner. Ayurveda's time-tested regimens—when aligned with the latest microbial and immunological insights—can form the backbone of personalised, low-cost, and sustainable healthcare models. However, to translate this vision into reality, structured initiatives must be taken across clinical, research, educational, and public health domains. The following directions outline a roadmap for future development:

- **Development of Trimester-Wise Guidelines**

There is a growing need to create trimester-specific Ayurvedic care pathways that account for the changing physiological and microbiome landscapes during pregnancy. These guidelines should be customised based on the expectant mother's *Prakriti* (constitutional type), seasonal variations, and regionally available food sources. Each trimester could be matched with appropriate Rasayana herbs, dietary protocols, yoga postures, and lifestyle

practices that optimise digestive fire (*Agni*), reduce stress-induced dysbiosis, and support immune tolerance. These guidelines can also incorporate modern markers such as stool microbiota diversity, inflammatory cytokines, or short-chain fatty acid levels, providing an integrative framework for ongoing clinical research and real-world application.

- **Microbiome Monitoring Studies**

To validate Ayurvedic interventions through a modern lens, rigorous microbiome monitoring studies are essential. Longitudinal cohort studies involving pregnant women and their infants can assess the influence of Ayurvedic dietary and herbal protocols on gut flora composition, metabolic profiles, and immune markers. For instance, researchers can examine the effects of specific regimens such as *Shatavari Ghritha* or *Triphala* on maternal gut diversity, neonatal IgA levels, and infant anthropometric growth. Ideally, these studies should also consider non-invasive, cost-effective biomarkers that align with Ayurvedic outcomes such as improved digestion, sound sleep, and healthy complexion. Collaborations between Ayurvedic colleges and genomic research labs can yield valuable datasets that support integrated policy recommendations.

- **Creation of Integrative Maternity Clinics**

To bridge the gap between traditional care and modern obstetrics, dedicated integrative maternity clinics can be established. These clinics would house both Ayurvedic practitioners and biomedical professionals, offering a hybrid model that respects and utilises both systems. For instance, while an obstetrician monitors fetal development using ultrasonography and standard prenatal tests, the Vaidya can guide the mother on dosha-balancing herbs, safe oil therapies, and postpartum regimens to prevent Vata vitiation. Such clinics can serve not only as care centres but also as research and training hubs where observational data are collected, interdisciplinary case discussions take place, and students from both systems learn side by side. A modular training programme for gynaecologists and Vaidyas to understand each other's lexicons could greatly enhance trust and cooperation.

- **Community Health Education**

Effective public health outreach is vital to bring this integrative vision to underserved populations. Community-based health education strategies must be designed to explain the

significance of the first 1000 days in relatable terms. Village health workers (ASHAs), Anganwadi staff, and traditional birth attendants can be trained to deliver simplified Ayurvedic messages such as the importance of *Ahara-Vihara*, breastfeeding, and postpartum rest. Visual aids, folk theatre, and culturally adapted mobile apps can be employed to spread awareness in local dialects. Video content featuring mothers and grandmothers practicing Ayurvedic traditions can enhance relatability and social acceptance. By embedding such messages in local festivals, women's groups, or self-help circles, a grassroots movement can be created that prioritises maternal and infant microbial health as part of community wellness.

Analytical Framework for Ayurvedic–Microbiome Convergence

To systematically evaluate and integrate Ayurvedic maternal-infant care practices with modern microbiome research, a robust analytical framework is essential. Such a framework allows researchers, clinicians, and policymakers to move beyond anecdotal and textual evidence toward measurable, replicable outcomes that can stand up to scientific scrutiny. The convergence of *Prasuti Tantra* and microbiome science can be operationalised by mapping Ayurvedic interventions onto microbiological, immunological, and clinical metrics. The proposed three-tiered framework comprises Input Variables, Process Mechanisms, and Outcome Indicators, creating a cohesive structure for both observational studies and clinical trials.

Input Variables

These are the modifiable and non-modifiable factors that influence both maternal and neonatal microbiota composition. In the Ayurvedic context, inputs reflect the individual's *Prakriti* (body constitution), seasonal influences (*Ritu*), and stage of pregnancy. The following input variables are central.

- **Maternal Diet:** Consumption of *Satmya* (compatible) foods, *Agni-balancing* herbs, seasonal fruits, and Rasayana-rich preparations like Shatavari Ghrita or Panchkola Yusha.
- **Mode of Delivery:** Whether the child is born vaginally or via C-section dramatically influences initial microbial colonization. Ayurvedic birthing protocols typically promote natural delivery unless contraindicated.
- **Use of Rasayana Herbs:** Intake of rejuvenative herbs such as Ashwagandha, Amalaki, and Guduchi during and after pregnancy may affect maternal immunity and gut flora.

- **Stress Levels:** Psychological stress alters gut-brain axis signaling and microbial composition. Ayurveda addresses stress through Abhyanga, meditation, and Sattvic lifestyle practices.
- **Breastfeeding Practices:** Early and exclusive breastfeeding is emphasized in both Ayurveda and modern neonatal microbiome care for its role in immunoglobulin transfer and microbial seeding.

Process Mechanisms

- These are the physiological and biochemical processes that translate the inputs into measurable changes within the host–microbiome ecosystem. They include:
- **Gut Barrier Integrity:** Ayurvedic practices supporting strong digestion (*Agni*) and low inflammation can improve mucosal barrier function, thereby preventing leaky gut syndrome and systemic inflammation.
- **Microbial Load Transfer:** Vaginal, fecal, and skin microbiota are transferred to the infant during and after delivery. Practices like Jatakarma (gentle skin contact), neonatal oil massage, and immediate breastfeeding facilitate this microbial inheritance.
- **Immune Priming:** Both systems recognize that early-life exposures shape immune responses. Ayurvedic formulations such as Swarna Bhasma (gold ash) given during neonatal rites may act as immunomodulators. These require scientific scrutiny for safety and mechanism of action.

Outcome Indicators

Outcomes are the quantifiable endpoints used to assess the success of the integrative protocol. These indicators help determine whether the Ayurvedic interventions are translating into real-world health benefits:

- **Infant Anthropometric Growth:** Parameters such as weight, height, and head circumference plotted against WHO growth standards.
- **Frequency of Infections:** Incidence of respiratory, gastrointestinal, or dermatological infections in infants as a proxy for immune resilience.
- **Microbial Diversity Indices:** Tools like the Shannon Index or Simpson’s Index to measure gut microbiota richness and evenness.
- **Maternal Postnatal Recovery Scores:** Metrics capturing fatigue levels, uterine involution, mood, and lactation success, which are key Ayurvedic outcomes as well.

- **Biochemical Markers** (optional in extended trials): Levels of short-chain fatty acids, cytokines (e.g., IL-6, TNF-alpha), or biomarkers of inflammation to understand mechanistic depth.

APPLICATION OF THE FRAMEWORK

This tripartite framework can be adapted for both **longitudinal observational studies** in communities and **interventional trials** in integrative hospitals. For instance, one could design a study that tracks pregnant women adhering to Garbhini Paricharya versus a control group using conventional prenatal care. Input data (diet logs, Rasayana intake), process data (stool microbiota profiling, salivary cortisol), and outcome data (birth weight, microbiome diversity in the infant) could be collected at specified intervals—e.g., each trimester, birth, 6 weeks, and 6 months postpartum.

By aligning traditional concepts like *Dosha*, *Agni*, and *Ojas* with modern biomedical markers, this framework enables a culturally sensitive yet scientifically rigorous investigation of maternal-infant health practices. It also offers policymakers a structure for evaluating and funding integrative interventions in public health systems.



Figure no.: 1 The Maternal-Infant Microbiome Transfer Pathway

Technological Enablers and Innovation

Emerging technologies offer the opportunity to bridge traditional wisdom with modern tools:

- **Digital Period Tracking and Pregnancy Apps:** These can be customised with Ayurvedic tips aligned to doshic changes and seasonal rhythms.
- **Microbiome Sequencing Kits:** Home kits may be employed in future research to track microbial shifts in mothers following traditional diets.
- **Wearable Stress Monitors:** Devices that track heart rate variability can be integrated into Ayurveda-based stress management during pregnancy.

Policy Implications and Community Health

To make such integrative approaches viable at scale, policy support is essential:

- **Inclusion in National Health Guidelines:** Elements of Garbhini and Sootika Paricharya can be included under India's Ayushman Bharat or National Health Mission programs.
- **Training Modules for Midwives and Health Workers:** Skilling frontline health workers in simple Ayurvedic principles relevant to microbiome and maternal care.
- **Incentivising Research:** Government funding agencies can support collaborative research proposals focused on Ayurvedic interventions and early-life microbiome development.

Ethical and Cultural Considerations

While integrating traditional practices, ethical considerations must be central:

- **Informed Consent:** Parents must be informed about both benefits and limitations of cultural practices adapted for modern settings.
- **Respect for Ritual Diversity:** Local customs around childbirth and neonatal care should be preserved where safe and scientifically acceptable.
- **Equity and Accessibility:** Interventions should be affordable and accessible to underserved rural and tribal populations.

Way Forward Through Education and Awareness

Public awareness campaigns that combine the narrative power of Ayurveda with evidence-based facts can change perception. Workshops, school-based health clubs, mobile apps, and animated videos can help young couples understand the vital importance of the first 1000 days.

Cross-training programs for both Ayurvedic and biomedical practitioners must become standard to foster mutual respect and a shared vocabulary. By nurturing this dialogue and committing to rigorous documentation, India can become a global leader in maternal-infant health models rooted in cultural heritage and validated by modern science.

CONCLUSION

Current obstetric paradigms largely overlook the ecological continuum linking maternal and infant microbiomes. Insights from Prasuti Tantra and Bal Roga offer time-tested, low-cost strategies that can enrich modern perinatal care without the pitfalls of antibiotic overuse or ultra-processed infant diets. By weaving Ayurvedic regimens—such as trimester-specific Rasayana rasas, post-partum Dashamoola-Kvatha, and tactile therapies like Shishu Abhyanga—into evidence-based obstetrics, clinicians may foster resilient microbial communities that buffer against non-communicable diseases. The proposed protocol advocates collaborative maternity teams where Vaidya, obstetrician, dietitian, and lactation consultant co-create personalised care plans. Long-term, this convergence promises not merely reduced morbidity but a generational uptick in cognitive and emotional flourishing, echoing Ayurveda's vision of Prajā Sampat (thriving progeny). Rigorous multicentric trials, community education, and policy support for integrative maternity clinics are imperative to translate these ancient insights into globally scalable interventions that honour both scientific rigour and cultural heritage.

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