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# ANTIBIOTIC OVERUSE IN CHILDREN: AN AYURVEDIC VIEW ON GUT HEALTH, *AGNI*, AND IMMUNITY — A CRITICAL REVIEW

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## ABSTRACT

Antibiotics rank among the most commonly prescribed medications in pediatric care. Although they are life-saving, their excessive use has raised concerns regarding long-term health effects, especially in children. Inappropriate and excessive antibiotic use in children has emerged as a major global health concern due to increasing antimicrobial resistance, gut microbiome disruption, recurrent infections, allergic disorders, and impaired immune development. Early life alterations in intestinal microbial ecology may have long-term metabolic, immunological, and neurodevelopmental consequences. Ayurveda, a traditional medical system, offers a comprehensive framework for understanding these changes through the concepts of *Agni* (digestive and metabolic capacity), *Ama* (toxic metabolic byproducts), and *Ojas* (the vital essence that supports immunity). Disturbance of digestive homeostasis due to improper diet, medications, and recurrent illness is believed to produce *Ama* formation and impaired tissue nourishment, predisposing children to recurrent disease. This review aims to provide a systems-based integrative perspective on the overuse of antibiotics in children by linking microbiome disturbances with Ayurvedic principles. Literature from classical Ayurvedic texts and contemporary databases, including PubMed, Scopus, and Web of Science was reviewed. Evidence suggests that repeated antibiotic exposure during childhood is associated with dysbiosis, reduced microbial diversity, obesity, inflammatory bowel disease, asthma, and immune dysregulation. Ayurvedic interventions, including *Deepana-Pachana*, *Rasayana*, dietary regulation, and microbiome-supportive practices, may help restore gut health and immune balance. Additionally, this article examines potential preventive and restorative strategies rooted in Ayurveda to enhance pediatric health.

**KEYWORDS:** Antibiotic overuse, gut microbiome, *Agni*, *Ama*, *Ojas*, Ayurveda, pediatric health, *Vyadhikshamatva*.

## INTRODUCTION

Antibiotic therapy has revolutionized modern medicine; however, its widespread and often irrational use has become a growing concern, particularly in pediatric populations. Children frequently receive antibiotics for self-limiting infections, leading to unnecessary exposure.[1,2] Studies indicate that a substantial proportion of pediatric antibiotic prescriptions are unnecessary, inappropriate in spectrum, or improper in duration.[3] Children are particularly vulnerable to antibiotic-induced alterations because early childhood is a critical period for gut microbiome maturation, immune system development, and metabolic programming.[4,5] Recent advances in

microbiome research suggest that antibiotics significantly alter gut microbial composition, which plays a crucial role in immune development and metabolic homeostasis.[6,7,8] Disruption of gut microbial balance (*dysbiosis*) has been associated with recurrent infections, asthma, allergic disorders, obesity, inflammatory bowel disease, and neurodevelopmental disturbances.[1,9,10]

Modern medicine increasingly recognizes the bidirectional connection between the gut microbiota and the immune system through the gut–immune axis. [11, 12]Ayurveda emphasizes the central role of digestion and metabolism in maintaining health. [13, 14] Concepts such as *Agni*, *Ama*, and *Ojas* offer a holistic framework that can be correlated with the modern understanding of gut health and immunity. Excessive use of strong medications and improper dietary habits are believed to impair *Agni*, leading to *Ama* formation, disturbed tissue metabolism, and recurrent disease susceptibility.[15]

This review attempts to bridge these perspectives to provide a deeper understanding of the overuse of antibiotics in children.

## AIM AND OBJECTIVES

### Aim

To critically review antibiotic overuse in children from modern and Ayurvedic perspectives with emphasis on gut health, *Agni*, and immunity.

### Objectives

- To analyze the impact of antibiotic overuse on pediatric gut microbiota
- To correlate gut dysbiosis with Ayurvedic concepts of *Agni* and *Ama*
- To evaluate the relationship between gut health and immunity
- To review Ayurvedic preventive and restorative strategies

## METHODOLOGY OF LITERATURE REVIEW

### Databases Searched

- PubMed
- Scopus
- Web of Science
- Google Scholar

### Ayurvedic Sources

- *Charaka Samhita*
- *Sushruta Samhita*
- *Ashtanga Hridaya*
- *Kashyapa Samhita*

### Inclusion Criteria

- Peer-reviewed pediatric and microbiome studies
- Ayurvedic classical references
- Reviews on immunity and gut health

### Exclusion Criteria

- Adult-only studies
- Non-English articles lacking reliable translation
- Non-peer-reviewed publications

### Time Period

2000–2025 for modern literature; classical Ayurvedic references without restriction.

## HISTORICAL PERSPECTIVE / CONCEPTUAL BACKGROUND

The *Kashyapa Samhita* provides a comprehensive examination of infant nutrition, digestive processes, gastrointestinal disorders, and the enhancement of immunity.[16]

Agni plays a vital role in the digestion of nutrients, the nourishment of tissues, and the proper functioning of the immune system.[15,17] Impaired *Agni* produces *Ama* (metabolic toxins), which predisposes children to recurrent illness and poor immunity.[15]

Classical literature describes children as physiologically fragile due to underdeveloped digestive systems, dominant *Kapha Dosha*, and incomplete tissue development.[16]

This concept aligns with the modern understanding of the immature gut microbiome and the development of the immune system during childhood.[6]

## THEMATIC REVIEW OF LITERATURE

### 1. Antibiotic Overuse in Pediatric Practice

Common indications for excessive antibiotic prescriptions include:

- Viral upper respiratory infections
- Otitis media
- Fever without bacterial confirmation
- Pharyngitis [3,18,19]

Broad-spectrum antibiotics are frequently prescribed despite lack of necessity.[19]

**Excessive antibiotic exposure during childhood has been associated with[1,2,6]**

- Altered gut microbiota
- Reduced microbial diversity
- Increased risk of recurrent infections
- Development of allergic and metabolic disorders
- Antimicrobial resistance

**Commonly Overused Antibiotics**

| Antibiotic | Common Pediatric Use | Common Dose |
|---|---|---|
| Amoxicillin-clavulanate | URTI | 25–45 mg/kg/day |
| Azithromycin | Fever/cough | 10 mg/kg/day |
| Cefixime | Gastrointestinal infections | 8 mg/kg/day |
| Ceftriaxone | Empirical therapy | 50–75 mg/kg/day |

**2. Gut Microbiome and Pediatric Health**

The gut microbiome is a dynamic ecosystem essential for:[8,13,14]

- Digestion and nutrient absorption
- Synthesis of vitamins and metabolites
- Immune system maturation
- Protection against pathogenic organisms
- Neurological and behavioral regulation

Antibiotics disturb this ecosystem by eliminating beneficial microorganisms along with pathogenic bacteria.[12,20] Emerging evidence suggests that gut dysbiosis in childhood may contribute to chronic inflammatory and metabolic disorders later in life.[6,21]

Antibiotics reduce microbial diversity and beneficial bacteria including:

- *Bifidobacterium*
- Lactobacillus[2,21]

**3. Physiological consequences of dysbiosis**

**A. Allergic Disorders**

Repeated antibiotic exposure increases risk of:

- Asthma
- Eczema
- Food allergies[9]

**B. Metabolic Disorders**

Early-life dysbiosis may predispose to:

- Childhood obesity
- Insulin resistance[1,22]

**C. Gastrointestinal Disorders**

- Antibiotic-associated diarrhea
- Inflammatory bowel disease[10,23]

**D. Neurodevelopmental Effects**

Gut-brain axis disruption may influence:

- Anxiety
- Behavioral disturbances [12]

**4. Ayurvedic Interpretation**

***Agni Dushti***

*Agni* is viewed as the cornerstone of health in Ayurveda, playing a crucial role in digestion, absorption, and metabolism.[13,14,24] Proper functioning of *Agni* ensures nourishment of tissues and maintenance of physiological balance.

Antibiotic overuse may suppress physiological digestive processes resulting in.

- Poor digestion
- Bloating
- Appetite loss
- Recurrent illness [16,17,25]

***Ama* Biogenesis**

*Ama* is described in Ayurveda as improperly digested or metabolized material that accumulates within the body.[13, 14] *Ama* blocks the body's channels (*srotas*), encourages inflammation, and disrupts normal physiological function.

**Characteristics of *Ama* include**

- Heaviness
- Stickiness
- Obstruction
- Toxicity

**Modern parallels may include**

- Metabolic endotoxins
- Inflammatory mediators
- Toxic metabolic byproducts
- Increased intestinal permeability

***Ojas* and Immunity in Children**

*Ojas* is considered the essential core of all bodily tissues, representing vitality, immunity, and the ability to resist illness.[14, 26] Children possess developing immunity and are more susceptible to disturbances affecting *Ojas*. Repeated illness and impaired digestion reduce immune vitality (*Ojas*), predisposing children to recurrent infections.[25]

**4. Gut health, immunity, and *vyadhikshamatva***

Ayurveda defines immunity as *Vyadhikshamatva*, the body's capacity to resist disease.[25]

**Healthy immunity depends on**

- Proper digestion (*Agni*)
- Nourished tissues
- Balanced intestinal ecology

**Modern immunology similarly recognizes the following**

- Gut-associated lymphoid tissue (GALT)
- Microbial regulation of immunity
- Mucosal immune maturation [11,12]

**5. Systems-based correlation**

| Aspect | Modern View | Ayurvedic View |
|---|---|---|
| Gut dysfunction | Dysbiosis | *Agni Dushti* |
| Toxin accumulation | Inflammation | *Ama* |
| Immunity | Immune modulation | *Vyadhikshamatva* |
| Restoration | Probiotics | *Deepana*, *Rasayana* |

This integrative framework demonstrates how gut disturbances may evolve into systemic dysfunction.

**6. Ayurvedic Management Approaches**

**6.1 *Deepana-Pachana* Therapy**

Measures that improve digestion and metabolism may help restore physiological balance and reduce *Ama*.

**A. *Shunthi Churna***

**Dose**
- 250–500 mg twice daily with honey

**Duration**
- 7–14 days

**Action**
- Improves digestion
- Reduces bloating

**B. *Ajamoda Churna***

**Dose**
- 250 mg twice daily after meals

**Duration**
- 7–14 days

**Action**
- Carminative
- Enhances *Agni*

**6.2 Gut-Supportive Dietary Measures**

**A. *Takra* (Buttermilk)**

**Dose**
- 50–100 ml after meals

**Action**
- Supports intestinal flora
- Improves digestion

**B. *Ghrita* (Medicated Ghee)**

**Dose**
- 5–10 ml daily

**Action**
- Intestinal nourishment
- Mucosal protection

**6.3 *Rasayana* Therapy**

**A. *Guduchi* (*Tinospora cordifolia*)**

**Dose**
- *Guduchi Satva* 250–500 mg twice daily

**Duration**
- 4–8 weeks

**Action**
- Immunomodulatory
- Anti-inflammatory

**B. *Chyawanprasha***

**Dose**
- 3–5 g daily with milk

**Duration**
- 2–3 months

**Action**
- Enhances immunity
- Improves resistance to infections

**C. *Brahmi Ghrita***

**Dose**
- 3–5 ml with warm milk

**Indication**
- Gut-brain axis support
- Neurodevelopmental balance

**6.4 Lifestyle Measures**
- Avoid junk food and excessive sugar
- Encourage freshly prepared warm food
- Maintain breastfeeding whenever possible
- Ensure adequate sleep (*Nidra*)
- Avoid unnecessary medication use

**7. Modern Preventive Strategies**

**Antibiotic Stewardship**

Includes:
- Rational prescription
- Narrow-spectrum antibiotic preference
- Appropriate duration and dosing[19,27]

**Probiotics**

***A. Lactobacillus rhamnosus GG***

**Dose**
- 5–10 billion CFU/day

***B. Saccharomyces boulardii***

**Dose**
- 250 mg twice daily

Used for prevention of antibiotic-associated diarrhea.[23]

**8. Clinical Implications**

Understanding antibiotic overuse through an integrative lens has important implications in pediatric healthcare.

**Rational Antibiotic Use**

- Avoid unnecessary prescriptions
- Encourage evidence-based antibiotic selection
- Promote antimicrobial stewardship

**Restorative Pediatric Care**

- Dietary correction after antibiotic exposure
- Restoration of gut health
- Enhancement of digestive capacity

**Preventive Strategies**

- Strengthening immunity
- Supporting microbiome diversity
- Lifestyle modification

## 9. Research Gaps and Limitations

- Restricted clinical trials in pediatric Ayurveda
- Lack of microbiome-based Ayurvedic studies
- Challenges in linking traditional concepts to molecular biomarkers
- Requirement for standardized integrative protocols [28,29]

## 10. Future Perspectives

- Comprehensive research on the pediatric microbiome
- Analysis of gut microbiota in relation to Ayurvedic treatments
- Integration of a rational antibiotic policy with conventional preventive healthcare
- Longitudinal studies on childhood immunity

## 11. DISCUSSION

Current research on the microbiome increasingly validates the idea that disturbances in the gut can have widespread effects on immunity and overall health.[30,31,32] Ayurveda offers a comprehensive understanding of these interconnected processes through the concepts of *Agni*, *Ama*, and *Ojas*. The parallels drawn between microbial dysbiosis and *Agni dushti* underscore the significance of Ayurvedic principles in modern pediatric practice.[13,24] Similarly, *Ama* can be viewed as a systemic expression of disrupted metabolism and inflammation.

This systems-oriented perspective promotes a more integrative model of pediatric healthcare that merges judicious antibiotic use with the restoration of gut and immune health.

## 11. CONCLUSION

The overuse of antibiotics in children poses a significant challenge to the integrity of the gut microbiome, immune development, and overall long-term health. Contemporary research increasingly highlights the crucial role of gut ecology in the development of pediatric immunity and metabolism. Ayurvedic principles such as *Agni*, *Ama*, *Grahani*, and *Vyadhikshamatva* offer a comprehensive framework for comprehending the physiological impacts of dysbiosis. Restorative approaches, including *Deepana-Pachana*, *Rasayana*, dietary management, and lifestyle adjustments, may contribute to the enhancement of gut health and immune equilibrium. An integrative approach to pediatric healthcare that prioritizes judicious antibiotic use and the maintenance of digestive health may yield sustainable benefits in the long run.[1,2,20]

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