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AN AYURVEDIC PERSPECTIVE: DRUG DOSE IN PAEDIATRICS

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ABSTRACT

Kaumarbhritya is the branch of Ayurveda dedicated to the care and treatment of children's diseases. One of the most challenging tasks for both Ayurvedic and Allopathic practitioners is determining the appropriate dosage for pediatric patients. In any system of medicine, treatment success relies on accurate diagnosis, proper drug selection, and the precise determination of dosage and timing. Acharya Kashyapa, regarded as the father of Ayurvedic pediatrics, provided detailed guidance on pediatric dosing. In various Ayurvedic texts, the concept of **Matra** (dose) is discussed, with different dosage forms mentioned. Since ancient times, when technology was less advanced, Ayurvedic physicians considered multiple factors—such as age, **Satva** (mental strength), **Prakriti** (constitution), and **Bala** (strength)—to determine the correct dose for a child. This article explores the ancient sages' understanding of pediatric drug dosing based on classical Ayurvedic literature. From the moment a child is born, various practices, like **Swarnaprashan** (gold administration) and **Lehan** (licking medicine), are performed to promote health and prevent diseases. Medicines are administered in specific doses, such as **amalkasthi**, **kolasthi**, **masha**, and **shana**. This review aims to discuss different pediatric formulations and their respective doses, which play a crucial role in maintaining children's health and treating illnesses.

KEYWORDS: Dose, formulations, children, pediatric care.

INTRODUCTION

Ayurvedic treatment methods are broadly categorized into two approaches: **Daiva Vyapashraya** (psychotherapy) and **Yukti Vyapashraya** (physical interventions). **Daiva Vyapashraya** includes practices such as chanting specific mantras, worshiping deities, and performing **Yagya** (sacred rituals). The second method, **Yukti Vyapashraya**, focuses on

drug therapy, which is considered a vital tool for patient management by Ayurvedic practitioners. However, the judicious use of drugs is essential, as improper use can cause harm or even be fatal.

Charakacharya, an eminent Ayurvedic scholar, emphasized that even poison can serve as an effective medicine when used wisely, whereas improper use of a beneficial substance like nectar can cause harm. In the **Kashyapa Samhita**, an authoritative text on Ayurvedic pediatrics, significant attention is given to the branch of **Kaumarbhritya** (pediatrics), where pediatric drug dosages are carefully prescribed based on a child's age.

In pediatric care, extreme measures like desiccation, excessive cleansing, or bloodletting are discouraged. Instead, treatments for children involve oral medications, ointments, and irrigation with drugs that are **Snigdha** (unctuous), **Shita** (cool), **Madhura** (sweet), and **Adahi** (non-burning). Ayurvedic texts provide guidelines for the dosages of various formulations, such as **Churna** (herbal powder), **Kalka** (paste), **Kashaya** (decoction), and **Ghrita** (ghee). However, determining appropriate dosages for children is often challenging for physicians.

In ancient times, dosages were measured using systems like **Magadha Mana** and **Kalinga Mana**, which were eventually replaced by modern units like milligrams and milliliters. These dosages were often based on natural objects like **Amalaki** (gooseberry) or **Kola** (jujube fruit). Despite the transition to the modern metric system, issues may arise in clinical practice when results do not meet expectations, often due to a lack of understanding or adherence to classical dosages. This article explores the ancient sages' perspectives on pediatric drug dosages as described in various Ayurvedic texts.

REVIEW OF LITERATURE

Matra (Dose)

Matra refers to the full measure or quantity of anything, encompassing aspects such as size, duration, number, or degree. In pharmacology, **posology** is the field that focuses on determining the appropriate dosages for medicinal remedies.

A **drug** is defined as a natural or synthetic substance that, when administered to a human, influences bodily functions or structures. It is used for diagnosing, mitigating, treating, preventing diseases, or providing relief from discomfort, thereby qualifying as a legal drug or

medicine. **Dose** refers to the specific quantity of medicine prescribed to be taken at a given time. The appropriate dosage can vary based on factors like age, weight, body surface area, the nature of the disease, and the functional maturity of the child.

In modern medicine, drugs are formulated into various forms such as syrups, injections, drops, and tablets to ensure easier administration, enhanced palatability, and improved efficacy. This adaptability helps in achieving the desired therapeutic effects while maintaining patient compliance, especially in pediatric care.[1]

In Ayurveda, various methods of drug preparation are designed to address the issues of palatability and potency, especially in pediatric care. These preparation methods are categorized as **Panchavidha Kashaya Kalpanas** (five types), **Shadvidha Kalpanas** (six types), and **Saptavidha Kalpanas** (seven types). These different forms help tailor the dosage and ensure the medicine is effective and palatable for patients, particularly children.

Acharya Charaka was particularly mindful of both the palatability and the potency of medicines, especially when prescribing for children. He emphasized that medicines intended for pediatric use should be **Madhura Rasatmaka** (sweet in taste) and should often be administered in the form of **Kashaya** (decoction), combined with milk. This thoughtful approach not only enhances the therapeutic effect but also ensures that the child can comfortably consume the medicine.

The following are some of the **Ayurvedic dosage forms (Kalpanas)** aimed at improving the administration of medicines in children:

1. **Swarasa** (juice extract)
2. **Kalka** (herbal paste)
3. **Kashaya** (decoction)
4. **Hima** (cold infusion)
5. **Phanta** (hot infusion)

These preparations reflect the ancient wisdom of Ayurveda in ensuring both efficacy and ease of use in drug administration.

Kalpana* according to different *Acharya

Sr. No.	*Acharya*	*Kalpana* (Form of medicine)
1	*Sharangadhara*	*Swarasa* (juice), *Kalka* (paste), *Kwatha* (decoctions), *Hima* (cold infusion), *Phanta* (hot infusion)
2	*Charaka*	*Swarasa*, *Kalka*, *Shrita* (decoctions), *Shita* (cold infusion), *Phanta*
3	*Sushruta*	*Swarasa*, *Kalka*, *Kwatha*, *Hima*, *Phanta*, *Kshirapaka* (milk boiled with the drugs)
4	*Kashyapa*	*Churna*, *Shitakashaya* (cold infusion), *Swarasa*, *Abhishava* (fermented drinks), *Phanta*, *Kalka*, *Kwatha*

Dose According to *Kashyapa Samhita*

Among all the treatises in Ayurveda, **Kashyapa Samhita** is the first to highlight **Kaumarbhritya** (Pediatrics) as the foremost branch within the eight branches of Ayurveda. According to **Acharya Kashyapa**, disease is the root cause of all suffering, while medicine brings relief and joy. He emphasized that when medicines are administered correctly, they act as nectar, but when used improperly, they can be as harmful as poison. Thus, it is essential for every physician to thoroughly understand not only the disease and the drugs but also the appropriate dosage for effective treatment.

Acharya Kashyapa paid particular attention to pediatric care by outlining specific doses for different drug formulations (**Kalpanas**) according to the child's age group. This precision ensures that treatments are both effective and safe for young patients, maintaining the delicate balance needed in pediatric healthcare. His teachings highlight the importance of tailoring the dose and formulation to suit the child's developmental stage.

Specific dose for different *kalpana* according to *Kashyapa Samhita*[2]

– Ghrita

Sr.No.	Age	Dose
1.	Immediately after birth	*Badariphala Beejatulya* (Size equivalent to the seed of Jujube fruit)
2.	5–10 days	Slightly increased
3.	10–20 days	Equal to half *Badariphala* (Jujube fruit)
4.	1month	Equal to one *Badariphala*
5.	1–2 months	One and half *Badariphala*
6.	3 months	Three *Badariphala*
7.	4 months	Equal to dry *Amalaki* (Indian gooseberry) fruit

8.	5–6 months	Equal to wet *Amalaki* fruit
9.	7–8 months	More than *Amalaki*

– *Churna*

Sr. No.	***Churna* (Powder)**	**Matra (Dose)**
1.	*Deepaniya* Churna (Appetizer powder)	*Agraparvanguli grahya* (The quantity of drug held between fore phalanges of fingers of hand)
2.	*Jeevaniya* (Longevity enhancer) and *Sanshamaniya churna* (Pacifying powder)	Double of *Deepaniya Churna Matra*
3.	*Vanama* (Emetic) and *Virechana* (Purgative)	*Churna* Half of *Deepaniya Churna* Matra

Kashaya

Sr. No.	***Kashaya* (Decoction)**	***Matra* (Dose)**
1.	*Dosha Nashaka Kashaya* (*Vata*, *Pitta*, *Kapha* eradicating Decoctions)	2 *Prasrita* (16 *Tola*=192 ml)
2.	*Vamaka* and *Virechaka Kashaya*	1 *Prasrita* (96 ml)
3.	*Deepaniya* and *Sanshamaniya Kashaya* (192 ml)	2 *Prasrita*

Kalka

Sr. No.	***Kalka* (Paste)**	***Matra* (Dose)**
1.	*Deepaniya Kalka*	1 *Karsh* (12 grams)
2.	*Jeevaniya* and *Sanshamaniya Kalka*	2 *Karsh* (24 grams)
3.	*Vamaka* and *Virechaka*	Half *Karsh* (6 grams)

In Kashyapa Samhita, Samanya Aushadhi Matra (general dosage) for a Navajata Shishu (newborn) is meticulously described. For administering Ghrita (ghee), the initial dose is recommended to be Vidangaphalatulya, which is equivalent to the size of a Vidanga (false black pepper fruit). As the child grows, the dose can be gradually increased, but the maximum limit for Ghrita is set to be Amalakiphala (the size of a Gooseberry fruit). The dose should not exceed this size to ensure the child's safety and maintain the balance between efficacy and gentleness in pediatric treatment.

This careful dosing approach reflects the ancient understanding of pediatric physiology, ensuring that the medicines are administered in an amount appropriate to the age and digestive capacity of the child, promoting health without causing harm.

In Sushruta Samhita, Acharya Sushruta has classified human life into three major stages: Balya (young age), Madhya (adult), and Vriddha (old age). The Balya stage, which pertains

to children, is further divided into three distinct phases based on dietary dependency:

1. Kshirada – The child is solely dependent on milk.
2. Kshirannada – The child is dependent on both milk and cereals.
3. Annada – The child depends primarily on cereals for nourishment.

For each of these stages, Acharya Sushruta has provided specific doses of medicines to suit the child's age and developmental needs:

- Kshirada Avastha (milk-dependent phase): The dose is adjusted to the child's milk-only diet and delicate digestion.
- Kshirannada Avastha (milk and cereal-dependent phase): The dose is slightly increased as the child's digestive capacity grows.
- Annada Avastha (cereal-dependent phase): The dose is further modified to match the child's increasing intake of solid foods.

This classification of age and dietary stages by Sushruta allows the physician to tailor treatment, ensuring the medicine is suitable for the child's digestive ability and stage of development.

In Sushruta Samhita, Acharya Sushruta has detailed the administration of drugs[3]

Sr. No.	Different age group	Matra (Dose)
1.	*Kshirada* (up to 1 year)	*Anguliparvadvaya grahya* (The quantity of medicine which adheres in between the apex of thumb and index finger. Honey or ghee should be used as Anupana.)
2.	*Kshirannada* (1–2 year)	Kolasthi (Medicines in the form of paste shall be given in an amount of size of seed of a kernel of a jujube fruit
3.	*Annada* (2–16 years)	*Kola Matra* (Equal to jujube fruit)

In Sharangadhara Samhita (13th century AD), one of the most authoritative texts of Ayurveda, a detailed discussion on Mana (the science of measurement) is provided. This text is significant for its comprehensive system of dosage determination, ranging from the smallest possible unit to much larger doses.

Key Highlights

1. Minimal to Maximum Doses: The dose in Sharangadhara Samhita is established from the smallest unit called Paramanu (atom) to the largest known as Tula (100 pala), showcasing a wide spectrum of dosage measurements.

2. Simplified Dosage: Sharangadhara simplified the dosing system by using Ratti (smallest measurable unit) and Masha, which can be easily converted into the modern metric system, making it easier to apply in current practice.
3. Contribution to Ayurvedic Dosage: This systematic approach to dose measurement in Sharangadhara Samhita has had a lasting influence on Ayurvedic practice, allowing practitioners to administer precise amounts of medicine.

Yoga Ratnakara also follows similar guidelines, emphasizing the standardization of doses in various medicinal formulations, thus enhancing the accuracy of treatments across different age groups.[4]

In Ayurveda posology E.g. *1 Ratti* = 125mg.

Dose according to *sharangdhara* and *Yogaratnakara* [5] is given below.

Dose According to *Sharangadhara* and *Yogaratnakara*

Sr. No.	Age	Dose
1	1 month	1 *Ratti* = 125 mg (*Churna*, *Kalka*, *Avaleha* formulation with ghee, honey, milk, sugar as Anupana)
2	2 months–1 year	increase by 1 *Ratti* every month up to 12 months
3	1 year–16 years	increase by 1 *Masha* (1.5 gm) every year (1 Masha–16 Masha=1.5 gm–12.5 gms)
4	For *Kwatha* (Decoction)	It should be given four times of above calculated dose as per age Eg. Dose of *Phalatrikadi Kashaya* for 1 year old child will be 6gm (6ml)

The drug doses prescribed in various Ayurvedic classics are based on ancient systems of **Mana** (measurement). In the past, when technology was limited, these measurements relied heavily on experiential knowledge and commonly used objects as references for weight, such as comparing doses to fruits like **Badariphalatulya** (size of a jujube), **Amalakiphalatulya** (size of a gooseberry), and **Vidangaphalatulya** (size of false black pepper).

This practice raises a significant question among modern physicians: Should the weight of these fruits be considered, or should the medicine be administered based on the size and shape of the fruits? Determining an exact weight is challenging due to the variety of fruits, which can differ significantly in weight depending on their species and region. Additionally, with the prevalence of genetically modified variants today, this variability has increased.

In ancient times, this inconsistency was less of an issue, as the fruits used were generally uniform in size and weight across regions. Thus, the ancient dosing system relies on

approximation rather than precision. Physicians today must exercise their judgment and adapt the doses for individual patients, recognizing that the ancient framework provides a guideline rather than an exact formula.[6]

Acharyas in Ayurveda emphasized precise measures for administering drugs, indicating that the size or shape of the specific drug should guide dosage rather than generic references like **Amla** or **Vidanga**. The term "**tulya**" (equivalent) highlights the importance of considering the shape and proportion of the particular object, making it more specific than merely assessing weight. However, this interpretation may vary among practitioners, so a prudent physician should apply **Yukti** (logic) in such matters.

For the dosage of **Churna** (herbal powder), Acharya Kashyapa recommended using **Anguli pramana** (finger measurements). He emphasized that the anthropometric measurements of the child receiving the medicine should be taken into account, rather than those of the mother or guardian. This is crucial because when referring to **Mana** (measurement) like **Prakunch**, the specific measurements of the individual consuming the drug are paramount.

Additionally, the dose should be adjusted for children with **Alpa Bala** (lower physical strength) or **Alpa Satva** (lower mental resilience), indicating a tailored approach to pediatric treatment. This flexibility ensures that the treatment is appropriate for each child's unique needs.

The **Sharangadhara** and **Yogaratnakara** guidelines for Ayurvedic dosing are notably clear and practical, facilitating easy conversion into the current metric system. These texts specify dosages based on compound formulations, addressing age-specific needs and thereby reducing uncertainty regarding pediatric drug dosing, particularly in Ayurvedic preparations.

The dosing guidelines outlined in the **Sharangadhara Samhita** are widely recognized and integrated into contemporary Ayurvedic practices. In instances where adult dosages are not explicitly defined, Acharyas provide general principles that take into account factors such as **Dosha** (body constitution), **Desha** (geographical location), **Kala** (time), **Vaya** (age), and **Agnibala** (digestive strength). These considerations assist physicians in accurately calculating appropriate doses. Below are examples of adult dosages for various **Kalpana** (formulations).

Dose of different *Kalpana* (doses form) according to *Sharangadhara Samhita.*

Sr.No.	*Kalpana*	Dose
1	*Churna* (herbal powder)	1 *Karsha* (12 grams)
2	*Vati* (pills)	*1Karsha* (12 grams)
3	*Svarasa* (juice) 6. 7.	Fresh ½ pala -2 Tola (27 ml.), Extracted after boiling-1 Pala (48ml)
4	*Avaleha* (Confections)	1 *Pala*
5	*Kwatha* (Decoction)	2 *Pala*
6	*Ghrita*/*Taila* (oil)	1 *Pala* (48 ml)
7	*Asava Arishta* (Fermented liquids)	2 *Pala* (96ml)

*In the **Ayurveda** system of medicine, specific guidelines for drug administration in children emphasize the importance of tailoring treatments to various developmental stages. In the **Kshirada Avastha** (up to 1 year), children rely entirely on their mothers for nourishment; hence, medications are administered to mothers to benefit neonates indirectly. It is crucial for pediatricians to assess the nature of the disease, including its etiology, signs, symptoms, and severity. If a condition stems from **Dushta Stanya** (vitiated breast milk) or improper maternal dietary habits, medications such as **Deepana** (appetizers), **Pachana** (digestives), and **Stanyashodhana** (milk purifiers) can be given to the mother based on adult dosages, thus alleviating the child's condition.*

*For more severe conditions requiring urgent treatment, such as **Ulbaka Vyadhi** (akin to pneumonia) and hyperpyrexia, medications should be administered directly to the child. In the **Kshirannada Avastha** (1 to 2 years), children begin to consume semi-solid foods while still relying on maternal nutrition. Thus, medications can be given to both the child and the mother.*

*During the **Annada Avastha** (2 to 16 years), as children wean off breast milk and can eat independently, treatment focuses solely on the child. **Acharya Sushruta** highlighted the importance of palatability and absorption, recommending honey or ghee as **Anupana** (substances taken with drugs) to enhance the efficacy of medications.*

*Further guidance is provided by **Acharya Vagbhata**, who designates specific **patthya** (wholesome foods) for each developmental stage: milk for the **Kshirada** stage, both milk and food for the **Kshirannada** stage, and only food for the **Annada** stage. The **Yogaratnakara** also notes that the guidelines regarding wholesome and unwholesome foods in **Jwaradi Roga** (fever-related ailments) should apply to children.*

The Ayurvedic classics outline various factors essential for effective treatment and dosage determination, underscoring their significance in achieving successful clinical outcomes.

Various factors affecting drug dose

In Ayurveda, several factors are considered crucial for effective treatment and dosage determination. These include:

1. **Dosha**: Refers to the physical constitution of an individual and the nature of the disease. It encompasses the three primary doshas—Vata, Pitta, and Kapha—that influence physiological and psychological characteristics.
2. **Dushya**: The part of the body that has become vitiated or affected by disease, which can involve tissues, organs, or systems.
3. **Bala**: The overall strength and vitality of the body, which can impact how an individual responds to treatment.
4. **Kala**: The timing of administration, which is vital for maximizing the effectiveness of the treatment.
5. **Agni**: Refers to the digestive fire or appetite, which plays a significant role in how well a drug is metabolized and utilized by the body.
6. **Prakriti**: The genetic factors and inherent body constitution that determine an individual's unique physical and mental characteristics.
7. **Vaya**: The age of the patient, which affects metabolic rate, drug absorption, and overall health status. It also includes considerations like body weight and surface area.
8. **Vyadhi**: The specific disease or condition being treated, which influences the choice of medication and dosage.
9. **Dravya**: The drug or substance being administered, which has specific properties that can affect treatment outcomes.
10. **Koshtha**: Refers to the biological membranes and their role in the distribution of drugs throughout the body.
11. **Satva**: The emotional quotient or mental state of the patient, which can influence treatment efficacy.
12. **Satmya**: The tolerance of the patient to certain drugs or therapies, which can vary widely among individuals.
13. **Rogavastha**: The pathological state of the disease, which includes its stage, severity, and progression.
14. **Prayoga Marga**: The route of administration of the drug, which can affect its absorption

and overall effectiveness.

15. **Desha**: The environment or geographical conditions that may impact the disease and treatment.
16. **Ahara Vyavastha**: The dietary habits and practices of the patient, which are essential for supporting health and treatment outcomes.
17. **Anupana**: The mediator or catalyst that may be used alongside the drug to enhance its effects or absorption.

Considering these factors holistically allows Ayurvedic practitioners to tailor treatments effectively, ensuring they are safe and beneficial for each individual patient.

Drug Doses According to Modern Science

In Modern science different formulae like Young‟s Formula[7], Dilling‟s Formula etc. are in use to calculate dose according to age. In order to produce drugs optimal effect, a drug must be present in an appropriate concentration at its site of action. The various steps involved in the pharmacokinetics are the concentration of the drug at the target site depends upon the dose or amount of drug, Liberation or release of active ingredient from the pharmaceutical formulation Absorption from the site of delivery into blood circulation. Distribution into various fluids compartment and tissues of the body. Transfer of drugs across all membranes largely depends on their dose or concentration, molecular size and shape, solubility at the site of absorption, degree of ionization and relative lipid solubility.

Metabolization of Drugs

- **Liver Metabolism**: Most drugs undergo metabolization primarily in the liver, where they are converted into various metabolites.
- **Excretion**:
  - **Water-soluble drugs**: These are predominantly excreted through urine.
  - **Lipid-soluble drugs**: Ionized lipid-soluble agents may accumulate in body tissues, leading to potential storage and delayed excretion.

Preferred Drug Formulations for Pediatric Patients

1. **Young Infants (up to 1 year)**:
   - **Formulation**: **Drops**
   - **Reason**: Small volume makes it easier to administer without overwhelming the infant.

2. **Preschool Children (1-5 years)**
   - **Formulation**: **Syrups or Suspensions**
   - **Reason**: Easier for young children to consume due to palatability and ease of swallowing.

3. **Children Above 2-3 Years**
   - **Formulation**: **Dispersible Tablets or Mouth-Dissolving Tablets**
   - **Reason**: These formulations can be taken without water, making them convenient for children.

4. **School-Aged Children (5 years and older)**:
   - **Formulation**: **Tablets or Capsules**
   - **Reason**: Most children in this age group can swallow tablets or capsules. However, some may refuse to take them.

5. **Adolescents**
   - **Consideration**: While most adolescents can swallow tablets, some may still refuse medication in this form.

Special Considerations

- **Vomiting**: Some children are particularly prone to vomiting after taking medication, which may necessitate alternative formulations or routes of administration.

This approach ensures that medications are administered effectively while considering the unique needs and preferences of pediatric patients.

There are some formulae to calculate the pediatric doses are given below:[8]

Upto 2yrs – Fried‟s Rule

Dose

$$= \frac{\text{Adult dose x Age in month}}{150}$$

Above 2yrs - Clark‟s Rule

Dose

$$= \frac{\text{Adult dose x weight in pounds}}{150}$$

Young‟s formula

$$= \frac{\text{Adult dose x age in year}}{Age + 12}$$

CONCLUSION

Acharya Kashyapa emphasizes the importance of selecting drugs that effectively combat disease without compromising the patient's strength. He asserts that medication should be administered until the disease is fully eradicated. Additionally, the choice of drug must consider various factors, including **Dosha** (body constitution), **Agni** (digestive fire), **Bala** (strength), **Vaya** (age), **Vyadhi** (disease), **Kostha** (digestive system), **Prakriti** (nature), **Satmya** (tolerance), **Desha** (environment), and **Kala** (timing).

The selected dose must be neither excessive nor insufficient, ensuring that a knowledgeable physician understands classical dosing guidelines according to age. It is noteworthy that some doses prescribed in ancient texts may appear high by modern standards. This discrepancy may arise from the differences in **Bala** and **Satva** (mental strength) of children in ancient times compared to today's youth.

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