



DRUG DOSES IN PEDIATRIC PRACTICE – AN AYURVEDIC LITERARY REVIEW

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ABSTRACT

Equilibrium of *Dosha's* and freedom from all diseases is called health. For this purpose of health, Acharya's have made *Ayurveda*. *Ayurveda* is one of the most ancient medical science in the world. It conceives and describes the basic and applied aspects of life process, health, disease and its management in terms of its own principles and approaches. W.H.O. defined health as state of complete physical, mental, social well-being and not merely the absence of disease. According to *Acharya Kashyapa Kaumarbhritya* is one of superior branch among *Ashtanga Ayurveda* which deals with diseases of children and their practical treatment. Dose fixation in pediatric patients is a critical job for both allopathic and *Ayurveda* physicians. Success of treatment is based on diagnosis, selection of drug, dose fixation and time of administration for any medical Science. In *Ayurvedic* therapeutics, drug therapy is given prime importance. In *Ayurveda*, the *Matra* (dose) of a drug has been mentioned in different treatises out of which *Acharya Kashyapa* is the pioneer of *Ayurvedic pediatric* medicine and he has well established the pediatric dosing system. *Ayurveda* physicians were using different *Matra's* for different dosage forms and also the dose was fixed according to age and many other factors like *Satva* (mental ability), *Prakriti* (constitution), *Bala* (physical strength) etc. This review article is related to pediatric drug doses from different *Ayurveda* classics.

KEYWORDS: *Ayurveda*, *Kaumarbhritya*, Dose, Drug, *Matra*, Pediatrics.

INTRODUCTION

Patient's treatment methods according to *Ayurveda* are broadly classified as '*Daiva vyapashraya* (psychotherapy) and '*Yukti vyapashraya* (physical interventions). *Daiva vyapashraya* (Psychotherapy) includes chanting of specific *mantra's* worshipping specific gods, performing *yagya*. Second treatment is based on drug therapy. *Ayurvedic* classics consider drug a very important patient management tool in the hands of physician or a therapist.

This tool needs to be handled judiciously, if not done so it is likely to prove injurious or sometimes fatal to the life of patient who receiving it.

Charkacharya while discussing different aspects of drugs and drug therapy says even a poison is an effective drug if used judiciously, whereas injudicious use of even nectar can prove harmful.

'*Kashyapa Samhita*' is the elementary primer of *Ayurveda* Pediatrics where prime importance is given to the branch of *Kaumarbhritya* (Pediatrics) and drug doses are described for children according to age.

Principle of treatment in children according to kashyapa:
 "Na tveva balasya vishoshanam hitam
 naivatisamshodhanaraktamokshane /
 Snighdhaiha
 sushitairmadhurairadahibhistatropacharoashanlepsecha
 naiha //” (*kashyapa sutrasthan 27/66*)

For children neither desiccation nor excessive cleansing measures and bloodletting is beneficial. They should be treated only by oral medications, ointments and irrigation with those drugs which are snigdha (unctuous), shita (cold), madhoora (sweet) and adahi (do not produce burning sensation).

Acharya's (Ancient *Ayurveda* physicians) have given a general guideline regarding the dose of *Churna* (herbal powder), *Kalka* (paste), *Kashaya* (decoction), *Ghrita* (Butter oil) etc. In pediatric age group most physicians find intricacy while prescribing medicine. In ancient era two different methods of measuring the objects were in use called *Magadha Mana* (*Ayurvedic* metric system) and *Kalinga Mana* (*Ayurvedic* metric system). To fix on *Matra* (dose) the proportion of different substances like *Amalaki* (Gooseberry), *Kola* (jujube fruit), *Vidanga*

(false black paper), *Anjali* (handfull), *Anguli* (Phalanges) etc was in practice. As the period progressed, those *Mana's* (Measurements) were replaced by milligrams, grams and milliliter etc. It took a long period from ancient era to modern era for getting these dose transformed into current metric system. In clinical practice sometimes it is found that, though the medicine was selected properly according to condition but still physician do not get expected result in particular cases. The main reason behind it may be due to negligence towards classical dose and its proper understanding. This article is aimed to understand the view of ancient sages related to pediatric drug doses from different *Ayurveda* classics.

Matra (Dose)

Matra is the full measure of anything or Measure of any kind of quantity, size, duration, number, degree etc. Posology is the branch of pharmacology and therapeutics concerned with a determination of the doses of remedies.

Drug is a "Natural or synthetic substance which when taken by a human being affects its functioning or

structure, and is used in the diagnosis, mitigation, treatment or prevention of a disease or relief of discomfort is called legal drug or medicine. Dose is the quantity of medicine prescribed to be taken at one time. As the dose varies with age, weight, surface area, nature of disease process and functional maturity of child. Modern medicines are given in the form of syrup, injections, drops, tablets etc for the easy administration, palatability and efficacy of drug.

Similarly in *Ayurveda*, *Panchavidha* (5types), *Shadvidha* (6 types), *Saptavidha* (7 types) *Kashaya Kalpanas* (Drug preparation methods) are described in the section of different dosage forms and these different dosage forms are prearranged to adjust the dose and to solve the issues of palatability and potency.

Acharaya charaka was very much conscious about the palatability and potency of drug so while describing the dose of child he said that the medicine which we are going to use for child should be *madhoor rasatmaka* medicated in the form of *kashaya* (decoction) and given with milk. These *kalpanas* are enlisted below:-

Kalpana according to different Acharya

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

Dose According To *Kashyapa Samhita*

Among the entire *Ayurveda* treatise, *Kashyapa Samhita* is first which placed the *Kaumarbhritya* (Pediatric) as First branch in eight branches of *Ayurveda*. According to *Acharya Kashyapa*, disease is the root cause of troubles and medicine is cause of pleasure. The medicines when

used properly it becomes nectar and improperly used drug acts like a poison so, every physician should have the knowledge of disease, drugs as well as dose. *Acharya Kashyapa* also described specific doses in different *Kalpana* for different pediatric age group.

Specific dose for different *kalpana* according to *Kashyapa samhita*

1 – Ghrita

Sr. No.	Age	Dose
1.	Immediately after birth	<i>Badariphala Beejatulya</i> (Size equivalent to the seed of Jujube fruit)
2.	5–10 days	Slightly increased
3.	10–20 days	Equal to half <i>Badariphala</i> (Jujube fruit)
4.	1month	Equal to one <i>Badariphala</i>
5.	1–2 months	One and half <i>Badariphala</i>
6.	3 months	Three <i>Badariphala</i>
7.	4 months	Equal to dry <i>Amalaki</i> (Indian gooseberry) fruit
8.	5–6 months	Equal to wet <i>Amalaki</i> fruit
9.	7–8 months	More than <i>Amalaki</i>

2 – 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

2- 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

3- 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)

Samanya aushadhi matra according to Kashyapa Samhita

For Navajata Shishu (newborn) Matra of Ghrita (ghee) is told as Vidangaphalatulya (equivalent to the size of false black pepper fruit), afterwards the dose is gradually increased. The dose of Ghrita can be increased up to Amalakuphala (size of fruit of Gooseberry) but not more than that.

Dose According to Sushruta Samhita

In the context of classification of age, Acharya Sushruta has classified the age as Balya (young age), Madhya (adult) and Vriddha (old age) and the group Balya has been further divided into Kshirada (child dependant only on milk), Kshirannada (child dependent upon milk and cereals) and Annada (depending upon cereals). Acharya Sushruta has given dose for Kshirada, Kshirannada and Annada Avastha which are enlisted below .

Age specific different drug doses according to Sushruta samhita

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)

Dose According to Sharangadhara and Yoga Ratnakara:-

Sharangadhara Samhita (13th AD) is one of the authentic book of Ayurveda where Mana (science of measurement) is discussed in detail. The classic has established the dose from minimal to maximum i.e. from Paramanu (atom) to Tula (100 pala). The dose is given in simplified measures as a ratti and Masha which can be easily converted into current metric system. This is the great contribution of sharangdhara samhita in Ayurveda posology E.g. 1 Ratti = 125mg.

Dose according to sharangdhara and Yogaratnakara is given below.

Dose According to Sharangadhara and Yogaratnakara

Sr. No.	Age	Dose
1	1 month	1 Ratti = 125 mg (<i>Churna, Kalka, Avaleha</i> 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 <i>Kwatha</i> (Decoction)	It should be given four times of above calculated dose as per age Eg. Dose of <i>Phalatrikadi Kashaya</i> for 1 year old child will be 6gm (6ml)

Drug doses mentioned in different classics of *Ayurveda* are given with respect to ancient systems of *Mana* (Measurement). In ancient era the technology was not evolved, so the framework of measurement was experience based and objects in custom employ were taken as measure of weight eg. *Badariphalatulya, Amalakiphalatulya, Vidangaphalatulya* etc. Most of the *Ayurveda* scholars are amazed regarding these *Manas*. The biggest query is arises in mind of physician that weight of *Vidanga/Amalaki* should be taken into account or medicine should be taken same as the shape of fruit of *Vidanga/Amalaki* etc. The exact weight cannot be assumed because *Amalaki, Kola* etc fruits have different varieties and also the weight varies with different regions and also all the fruits do not carry same weight. This is the situation these days because of wide genetically modified variants available in the market. In olden days this was not the case. May be *Kola* has remained the same even in current times., the only standard they had was to take it in the dosage of common fruits available in every region. So only approximation could be expected with the ancient dosing system and not accuracy and with the help of own logic physician should manage doses for different patient.

Acharya's were clear in their ways. It is to be taken in the size or weight of the particular drug and not *Amla* or *vidanga* as such. The word "*tulya*" (equivalent) is being used in quotation, so it becomes more specific to consider shape/ proportion of the particular object rather

than weight. Still this opinion can vary from person to person; so a wise physician should use *Yukti* (logic) in such cases. For *Churna matra, Acharya Kashyapa* has used *Anguli pramana*. For this, the *pramana* of recipient child should be considered and not the mother or guardian. This is clarified by *Acharya Kashyapa* which comments whenever *Mana* (measurement) like *Prakunch* needs to be referred in drug administration then the *Pramana* (Anthropometrical measurements) of the person who is going to consume the medicine should be considered. Also, dose can be minimized in *Alpa Bala* (less body strength) and *Alpa Satva* (less mental strength) child.

Sharangadhara and *Yogaratnakara* guidelines are more comprehensible and acceptable as the dose mentioned in these *Samhita* can be easily converted into current metric system. The dose is given considering the compound formulation and commonly used *Kalpana* (formulation) are discussed with their age specific dose. This helps to counteract the uncertainty about pediatric drug doses especially for *Ayurveda* formulation.

Sharangadhara Samhita dose fixation guideline is widely accepted in *Ayurveda* dosing system . When adult dose is not defined, the general guidelines given by *Acharya's* considering the contents of the drug and other parameters such as *Dosha, Desha, Kala, Vaya, Agnibala* etc. physician has to calculate the dose. Some of the adult doses of different *Kalpana* are shown below

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

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

Ayurveda system of medicine, some specifics are given for drug administration in children. In *Kshirada Avastha* (up to 1 year) medicine should be given to mother as child is totally dependent upon mother for nourishment so drug given by mother indirectly reach up to neonates. Now, it is the wise duty of every pediatrician to look after the nature of disease with its etiology, signs, symptoms and severity. When the disease seems to be

originated from *Dushta Stanya* (vitiated breast milk) or improper dietary habits of mother, medicine should be given to mother following adult dose. Eg. In *Kaphadushta Stanya* (vitiated milk due to body humour), *Deepana* (Appetizer), *Pachana* (digestive), *stanyashodhana* (Milk purifier) medicine given to mother gives relief in child's disease. In Some diseases only medicine should be given to child as they having

absolute severity and the diseases which need prompt treatment to child only such as *Ulbaka Vyadhi* (equivalent to Pneumonia), Hyperpyrexia etc. In kshirannada *Avastha* (1 to 2 years) children can eat some semisolid food and also depend on mother for nutrition. So, medicine should be given to both children and mother. In *Annada Avastha* (2 year to 16 years) weaning of breast milk has been done and child is capable of taking their own food so there is no need to give medicine to mother & so medicine should be given only to the child. *Acharya Sushruta* has specifically mentioned honey or ghee as *Anupana* (substance which taken with drug or medicine). From this, it is clear that *Acharya's* were concerned about the palatability, absorption of drug and rapid action of drug. They also described the *patthya* for children. According to *acharya Vagbhata ksheer is pthya* for *sheerad avastha ksheer* and *anna* for *ksheerannad avstha* and only *anna* for *annad avstha*, whereas *Yogaradnakra* said that the *patthya apatthya* described in *jwaradi roga* should be follows for children also.

For the treatment purpose Ayurveda Classics has mentioned various factors to be considered in treatment for successful clinical practice and these factors are very important in dose fixation.

Various factors affecting drug dose

Dosha (Physical constitution and nature of disease)

Dushya (Part vitiated in body)

Bala (Body strength)

Kala (Time of administration)

Agni (Appetite/Digestive fire)

Prakriti (Genetic factors and body constitution)

Vaya (Age, body weight, surface area)

Vyadhi (Disease)

Dravya (Drug)

Koshtha (Biological membrane/distribution)

Satva (Emotional quotient)

Satmya (Tolerance)

Rogavastha (Pathological state)

Prayoga Marga (Route of administration)

Desha (Environment)

Ahara Vyavastha (Diet and dietetic practices)

Anupana (Mediator/Catalyst)

DISCUSSION

In Modern science different formulae like Young's Formula, 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,

1. Liberation or release of active ingredient from the pharmaceutical formulation
2. Absorption from the site of delivery into blood circulation.

3. Distribution into various fluids compartment and tissues of the body.
4. 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.
5. Metabolization of the drug mostly in the liver.
6. The water soluble drug is largely excreted in the urine while ionized lipid soluble agents may be stored in the body tissues.

Drops formulation are preferred in young infant due to small volume of the medicine to be administered. In preschool children, syrup or suspension formulation is usually given. Dispersible tablets or mouth dissolving tablets can be given to children above 2-3yrs of age. Most school going children should be able to swallow tablets or capsules but at times even an adolescent child may refuse to take a tablet. Some children are extremely prone to vomit when a medicine is given to them. There are some formulae to calculate the pediatric doses are given below:-

A) Upto 2yrs – Fried's Rule

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

B) Above 2yrs - Clark's Rule

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

C) Young's formula = $\frac{\text{Adult dose} \times \text{age in year}}{\text{Age} + 12}$

CONCLUSION

Acharya Kashyapa quotes that "The drug, which does not destroy the patient's strength but destroy the disease potency, should be used till complete eradication of disease." In continuation to this drug should also be selected after observing various factors like *Dosha, Agni, Bala, Vaya, Vyadhi, Kostha, Prakriti, Satmya, Desha, Kala*, etc. Dose of medicine selected for the treatment of disease should not be too excess or too low. So, a wise physician anticipating complete cure of disease should have knowledge about classical dose of medicine according to age. Also some doses mentioned in classics seem to be higher in today's perspective. The reason behind this may be the *Bala* and *Satva* of children in ancient period was different as compared to today's generation.

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