Int J Ayu Pharm Chem
ISSN 2350-0204
www.ijapc.com

REVIEW ARTICLE

Paediatric Nutrition, Complementary Feeding and Ayurveda: Practical Approach

Author: Lalit Mohan Bhatt[1]

Co Authors: Neeraj Agrawal[2], Lowkesh Chandravanshi[3], Satyawati Rathia[4], Swati Bhatt[5] and Hemant Kumar Chouhan[6]

[1-4,6]Dept. of Kaumarabhritya, Shri Narayan Prashad Awasthi Government Ayurved College, Raipur, CG, India
[5]Dept. of Panchkarma, Uttarakhand Ayurved University, Gurukul Campus Haridwar, Uttarakhand, India

ABSTRACT

The nutritional components attained from *Ahara* are responsible for the formation of healthy human tissue and disease as well. As far as pediatrics is concern the very first text related to this branch describes *Ahara* as *Mahabhaisajya* (i.e., most effective medicine) The wide range of *Ahara* classification in Ayurveda permits the concept of individualized diet plan as per the body constitution. Child's physical and mental health are permanently impacted by their food and lifestyle choices from an early age. To understand the concept of child nutrition, a review of the literature from ancient Ayurvedic texts, journals, and surveys was conducted. We then presented this paper with a wholesome strategy for child nutrition using Ayurvedic concepts. In recent years Global and Indian market of formula feed and baby food products is growing fast, In India alone it expected to grow at the rate of 9% till 2027. This rise is a major concern for Additives and formula feed associated illness like chronic inflammation, hormonal disbalances, Obesity, Diabetes and PCOS in pediatric age group. In Ayurveda children are divided into three categories i.e., *Ksheerap*, *Ksheerannada*, and *Annad Awastha*. In pediatrics, nutrition from womb to adolescent is unique and age dependent due to different nutritional requirement at different stage of life. This paper focuses on the same and related ayurveda concepts, ideal diet as per age.

Key Words *Ayurveda, Pediatric nutrition, Ahara, Additives*

Received 11th April 23 Accepted 04th May 23 Published 10thMay 2023

INTRODUCTION

The pediatric age group is a major factor responsible for deciding the future direction of health and wealth in any country. *Ahara* (i.e., diet) is the first among three supportive pillars of life, as diet is important to maintain state of health and management of disease[1]. Ayurveda literatures have kept *Ahara* as supreme and basic need of human beings. The nutritional components attained from *Ahara* are responsible for the formation of healthy human tissue and disease as well[2]. As far as pediatrics is concern the very first text related to this branch describes *Ahara* as *Mahabhaisajya* (i.e., most effective

REVIEW ARTICLE

medicine)[3]. The *Ahara* in Ayurveda is classified in many ways like, Pattern of intake, effect during process of digestion i.e., *Virya* and effect on *Dosha*, physico-chemical composition (*Panchbhautika sanghatan*) and *Rasa* present in it. This wide range of classification in classics permits the concept of individualized diet plan as per the body constitution. Concepts of nutrition in pediatrics from womb to adolescent is unique and age dependent due to different nutritional requirement at different stage of life but, the manner of tissue nutrition is not same during all the phases of life[4].

Prenatal malnutrition may impede fetal growth and result in inadequate brain development e.g., Neural tube defects due to deficiency of Folic acid. This fact was well understood by *Kashyapa* so, he included *Garbha* in pediatric age classification[5]. The mother's diet still affects the child's growth after delivery, and in later years, the child's own diet. Thus, A child's physical and mental health are permanently impacted by their food and lifestyle choices from an early age. Advancements in research in this segment and related consequences has created a need for exploration and implementation of traditional ayurveda description along with its scientific validation.

MATERIALS AND METHODS

To understand the concept of child nutrition, a review of the literature from ancient Ayurvedic texts, journals, and surveys was conducted. We then presented this paper with a wholesome strategy for child nutrition using Ayurvedic concepts.

Table 1 Classical description, modification and present scenario

Age group	What UNICEF tells us[7]	Ayurveda classification	Ayurveda recommendations[8,9,10,11]
Prenatal	➢ The risk of preterm delivery and low birthweight, which in turn raises the risk of neonatal death, stunting, and wasting, are all increased by maternal malnutrition, which manifests as underweight and anaemia. ➢ Maternal overweight is a frequent pregnancy complication that raises the risk of gestational diabetes and pre-eclampsia, two conditions that could be fatal. It can also cause labor complications and a higher rate of postpartum hemorrhage.	*Garbha*	➢ Detailed Month wise description of mother diet is available in Charaka and Sushruta Samhita. ➢ Milk, Butter, *Ghee*, Honey, non veg soups and some medicinally important plants and procedures are described to prevent maternal and fetal complications.
0-5 Months	➢ UNICEF and WHO recommend exclusive breastfeeding for the first six months. ➢ Colostrum, a mother's first milk product, safeguards an infant's developing immune system from illness and inflammation.	*Ksheerapa*	➢ Exclusive breastfeeding for the first six months is advised. mother's first milk product is called *Piyusha* and it improves immune power of body. ➢ In case of absence of breast milk- Wet-nurse can feed additionally; Cow and Goat milk can be given as per the

REVIEW ARTICLE

	➢ The rise in the promotion, sales and use of breastmilk substitutes, including formulas and toddler milks, is an area of growing concern.		digestive capacity. Now a days this practice has been replaced by formula feed.
6 – 2 years	➢ Nutritional needs for growth and development greater per kilogram of bodyweight than at any other time of life, making them especially vulnerable to nutritional deficiencies and growth faltering. ➢ Foods animal origin, such as meat, fish, eggs, and dairy products, which are good sources of vitamin A, iron, zinc, and calcium as well as other important nutrients. ➢ Animal source food is densely packed with a range of essential micronutrients, well suited to the smaller stomachs of younger children. ➢ The fastest growing category of formula milk is toddler milks, marketed for children aged between 13 and 36 months. Most toddler milks contain a combination of powdered milk without its natural fats and corn syrup and other added sweeteners and vegetable oil. these drinks may also increase the child's preference for sweet tastes leading to serious health hazard in future.	*Ksheerapa* – up to 1 year *Kasheerannada* 1-2 year	➢ Main diet continues to be milk. ➢ Sushruta advises to administer *Laghu* and *Hitkara Ahara* after 6 months. ➢ As complimentary diet Kashyapa introduces *Fruit* at Six months indicates liquid diet (fruit juices) and Pulses and Cereals at 10 moths i.e. semisolid diet. This pattern seems more practical as compare to other texts. ➢ So whole process has a flow from gradual introduction of liquid to semisolid food and weaning of breastfeed. Thus, complimentary feed is a bridge between liquid to solid diet. ➢ Charaka advised to avoid excessive warm, cold, dry and sour substances thus, he recommends a balance, tasty and palatable diet.

DISCUSSION

According to their diet and nutritional requirements, children are broadly divided into three categories in Ayurveda, which are as follows[6]:

➢ *Ksheerapa Awastha*- Up to 1 year of life consuming only breast milk.

➢ *Ksheerannada Awastha*- Up to 2 years of life along with milk child is consuming mainly liquid and semi-solid food.

➢ *Annada Awastha*- After 2 years and up to 16years of life where child consumes all diet like adults.

Modern science also accepts this kind of age dependent nutritional requirements for the Infants and children. This requirement, classical description its modification and present scenario can be better understood by the Table No. 1.

The age group from 3 to 16 years is known as *Annada* in Ayurveda and compared to prior age group the digestive capacity of this age group is stable but, *Dhatus* remain in the developing phase[12]. At this stage of life family diet, exposure to digital advertisement and social environment plays a major role in feeding habits of children. ICMR age specific recommended dietary allowance (RDA) i.e., *Agni-bala* for Infants and children's (Table No.2)[13] can be achieved by diet described in the Ayurveda literature.

REVIEW ARTICLE

The concept of Recommended Dietary Allowance (RDA) is similar to concept of dietary intake described by Charaka based on *Agnibala* measurement where dietary intake depends on digestive capacity of individual[14]. The importance of every food component is unique, we are describing here some important dietary category, source and their age specific importance.

Breastfeed and its benefits has been discussed in detail in Table No. 1. In recent years practice of formula feeding is being popular and increasing due to its beneficial features like improved digestibility of protein components, addition of bioactive proteins such as Lactoferrin, Osteopontin, acting as anti-bacterial, anti-vital agents and improves immunity. Bioactive milk fat globule membrane (MFGM) rich formula feeds show decreased incidence of diarrhea in infants. Some disadvantages of formula feed are significantly higher concentration of amino acids and blood urea nitrogen than breastfeed infants[15].

Energy – According to the WHO, babies in developing nations with "average" breast milk intake require about 200 kcal per day at 6 to 8 months old, 300 kcal per day at 9 to 11 months old, and 550 kcal per day at 12 to 23 months old in terms of energy from complementary foods[16].

Protein are the building elements of the body and structurally, proteins are large structures made up of chains of amino acids connected by peptide bonds. Whey or casein proteins makes the majority of protein ingested by newborns. For the first six months of life, all protein and amino acid needs are satisfied by exclusive breastfeeding. Methionine content in whey and cysteine content in casein is lower, both these proteins found abundantly in breast milk. Protein in colostrum is more bioavailable, so breastfed babies have access to more protein. Protein serves a significant anabolic role in the development of muscle and tissue; cellular development and repair can be hampered by a lack of proteins in later age.

Fats are concentrated energy sources and primary source of energy in infants. The maturation of neurons and the retina, as well as proper growth and development, depend on the long-chain polyunsaturated fatty acids n-6 and n-3. Fatty acids are the form in which lipids are passed from the mother to the fetus across the placenta during the fetal phase. In breastfed infants, triglycerides account for up to >90% of all lipid consumption, with phospholipids and cholesterol serving as minor sources. Fats also make up 40–55% of the total dietary energy intake.

Vitamins and minerals, are micronutrients required in smaller quantities, they are vital for the production of hormones, enzymes and other substances that manage growth and development. Micronutrient malnutrition, also known as "hidden hunger," has adverse effects that are serious and include early mortality, poor health, vision problems, stunted growth, mental illness, learning disabilities, and lassitude. The vitamins of special importance are A, D, B Complex (specially B6 and B12) and C. The food rich in

REVIEW ARTICLE

these components are shown in Figure 1 and Figure 2.

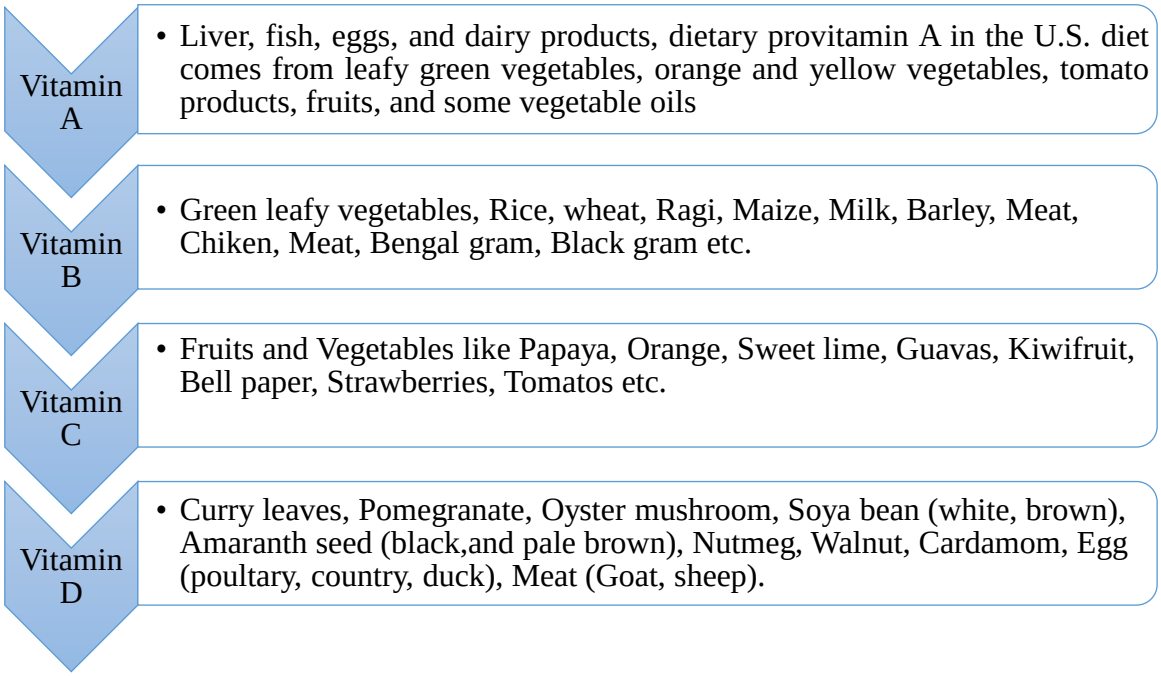

Figure 1 Vitamins and food sources

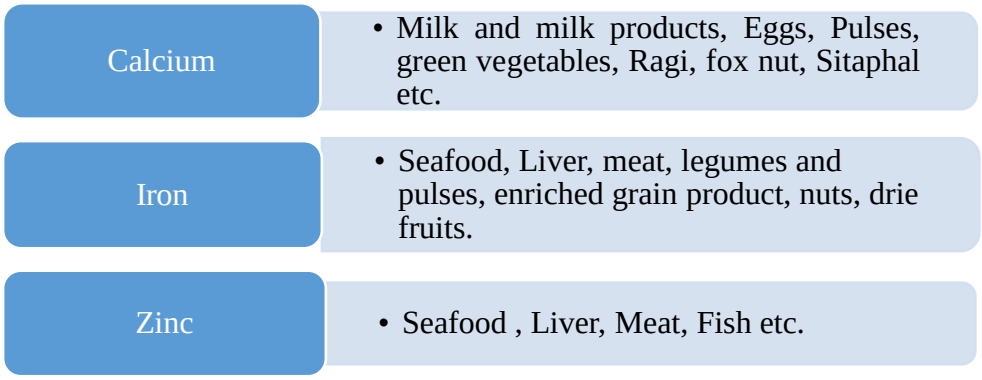

Figure 2 Micronutrients and food sources

Major biological actions of Vitamin A are in vision, cellular differentiation and immunity. Breast milk contains plenty of vitamin A, but formula-fed infants may need extra amount to prevent health hazards. Growing evidence suggests that vitamin D influences both the innate immune system's capacity to fight pathogens and the adaptive immune system's capacity to control autoimmune disease. Vitamin D and calcium are both critical for musculoskeletal health in growing years, the neurohormonal effects of vitamin D on brain growth and behaviour, with a connection to mental health disorders, are beginning to be revealed by additional research[17]. Calcium plays an important role in bone formation, muscle contraction, transmitting messages through the nerves, and the release of hormones. Calcium plays an important role in bone formation, muscle contraction, transmitting messages through the nerves, and the release of hormones. Prevention of rickets, hypocalcaemia and other deficiency consequences in infants and

REVIEW ARTICLE

children can be done with RDA for the age (Table No. 2). Due to inadequate food intake, high dietary phytate content, lack of animal food consumption, and increased faecal losses during diarrhoea, zinc deficiency is a prevalent condition in children from developing nations. Zinc plays an important role in cellular metabolism and has a significant impact on the gut mucosa and immune system. Supplementing with zinc has demonstrated notable advantages in the management and prevention of diarrhoea and pneumonia[18,19]. Early childhood has a higher daily requirement for iron than maturity does and is characterised by high physiological iron demand to support processes including blood volume expansion, brain development and tissue growth. Iron is also required for other essential functions including the generation of effective immune responses.

Table 2 ICMR - Recommended Dietary Allowance (RDA) for Indians (Age specific *Agni-bala*)

Age group	Energy (Kcal/Kg/day)	Protein (g/day)	Fat (g/day)	Calcium (mg/day)	Iron (mg/day)	Zinc (mg/day)	Vitamin A (µg/day)	Vitamin D (IU/day)
0-6 Month	550	6.7	25	300	-	-	350	400
6-12 Month	670	8.8	25	300	2-3	2.5	350	400
1-3 Year	1010	9.2	25	500	8	3.3	390	400
4-6 Year	1360	16	25	550	11	34.5	510	600

Balanced Diet in Infants:[20] According to ICMR following elements needs to be taken into account when creating an infant's diet: Calories derived from different groups should be as Carbohydrates 55-60%, Proteins 10- 15% and Fats- 30-35% shown in Figure 3. The proportion of proteins from pulses to those from grains should be 4:1. Green leafy vegetables and other vegetables should be eaten daily in amounts of at least 50gm. Energy from jaggery and refined sugars should be limited to 5% of total caloric intake, water intake should be adequate. Economic, cultural and geographical differences must be taken into account and food must be affordable, acceptable and accessible.

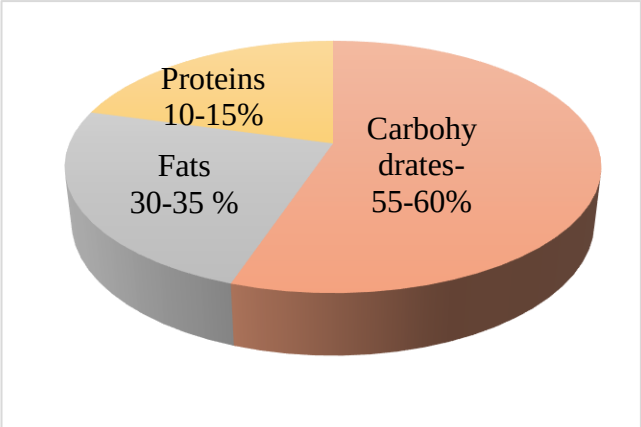

Figure 3 Calorie distribution of food

There are various factors that regulate the nutrition of children of different age groups. Such as maternal dietary intake during pregnancy, initiation and continuation of breastfeeding, use

REVIEW ARTICLE

of breastmilk substitutes, family dietary environment, water and sanitation systems, family socioeconomic status, food advertising, packaged food consumption (determining additive intake), frequency of fruit, vegetable and mineral intake, food processing, family meal preparation habits, food system globalization, political commitments, economic priorities, and also children's diets and eating habits. All of these factors may adversely affect a child's eating habits and ultimately affect their nutritional status. For an example additive of the packed food have their own consequences such as Bisphenol A (BPA) exposure affected behavioural and emotional regulation domains at 3 years of age, especially among girls. Similarly, studies suggest other additives like phthalates, perfluoroalkyl substances, perchlorate, artificial food colours and nitrates/nitrites, given their links to endocrine disruption, attention-deficit hyperactivity disorder (ADHD), and chronic conditions such as cancer, type 2 diabetes and obesity[21].

Ayurveda aspect of balance diet: Ayurveda has a vast description of the diet, lifestyle and other associated factors for feeding practices. According to ayurveda, a balanced diet includes foods that promote health and shield against illness. Dietary substances divided into *Guru* and *Laghu* according to their *Panchbhautika* composition and, these should be consumed according to *Agni bala* (Can be correlated to RDA of ICMR Table No.2) of the individual. Such as *Guru dravya* should be consumed half or one third of total stomach capacity and overeating of *Laghu dravya* is not recommended, food consumed in this manner maintains health and vitality[22]. Additionally, the *Rasa* composition of consumed diet is responsible for *Dosha Samyata*, *prakopta* and three kinds of *Satmya* (*Pravar*, *Avar* and *Madhya*) produced on regular practice have, their relevant effect in the body[23]. The increasing prevalence of disease like Obesity, Diabetes Mellitus, Hypertension and PCOD shows the dietary predominance of *Madhur*, *Amla* and *Lavan Rasa* in pediatric age group. Which also associated with the *Avar Ras Satmya* and consequently weak immune power. So, its need of time to develop food pyramid based on the Ayurveda classification of food and we have made an attempt which is shown in Figure 4.

Figure 4 Ayurveda food pyramid

CONCLUSION

Food system over the world is mostly commercialized in modern era which shapes the choices of diet for population. High calorie serving, added preservatives and processing in unhealthy substances is another aspect of commercialized food chain system, which is

responsible for unhealthy eating habits in paediatric age group. Ayurveda concept of *Rasa Satmyata*, *Asth-Ahar-Vidhi-Vishesatayana* and *Dwash-Ashan-Pravicharana* need to be follow from childhood for better health of Children. Ayurveda concept of *Sanskara* (i.e., commercial fortification) of staple food with micronutrients and nootropic drugs can fulfil micronutrient requirements and promote brain development. Thus, conversion and transformation of food chain on the basis of Ayurveda concepts, adaptation of RDA values for dietary intake can improve the healthy eating skills in paediatric age group.

REVIEW ARTICLE

REFERENCES

1. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi –Sutrasthana Ch. 11 ver. 35 Reprint edition 2020, Varanasi Chaukhambha Surbharati Academy, page no. 199.

2. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi –Sutrasthana Ch. 28 ver. 45 Reprint edition 2020, Varanasi Chaukhambha Surbharati Academy, page no. 505.

3. Acharya Kashyap, Kashyap Samhita- "VIDHYOTINI" Hindi commentary by Ayurvedalankar Shri Satyapala Bhisagacharya Khilsthana Ch. 4 Ver. 6 Reprint edition 2012, Varanasi Chaukhambha Prakashan, Page no. 378

4. Acharya Sushruta, Sushruta Samhita- "AYURVEDTATVASANDIPIKA" Hindi commentary by Kaviraj Dr. Ambikadatta Shastri – Sutrasthan – Ch. 14 ver. 3, Reprint Edition 2014, Varanasi Chaukhmbha Sanskrit Sansthana , Page no. 61.

5. Acharya Kashyap, Kashyap Samhita- "VIDHYOTINI" Hindi commentary by Ayurvedalankar Shri Satyapala Bhisagacharya Khilsthana Ch. 3 Ver. 72-74 Reprint edition 2012, Varanasi Chaukhambha Prakashan, Page no. 371.

6. Acharya Sushruta, Sushruta Samhita- "AYURVEDTATVASANDIPIKA" Hindi commentary by Kaviraj Dr. Ambikadatta Shastri – Sutrasthan – Ch. 35 ver. 34, Reprint Edition 2014, Varanasi Chaukhmbha Sanskrit Sansthana , Page no. 173.

7. UNICEF, the state of world's children 2019, Children, food and nutrition growing well in changing world, Chapter 2 Feeding a child for life, published in October 2019, page no. 65 -78.

8. Acharya Sushruta, Sushruta Samhita- "AYURVEDTATVASANDIPIKA" Hindi commentary by Kaviraj Dr. Ambikadatta Shastri – Sharirsthana – Ch. 3 ver. 15, Reprint Edition 2018, Varanasi Chaukhmbha Sanskrit Sansthana, Page no. 31.

9. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi –Sharirsthana Ch. 8 ver. 65 Reprint edition 2013, Varanasi Chaukhambha Surbharati Academy, page no. 961

10. Acharya Sushruta, Sushruta Samhita- "AYURVEDTATVASANDIPIKA" Hindi commentary by Kaviraj Dr. Ambikadatta Shastri – Sharirsthana – Ch. 10 ver. 54, Reprint Edition 2018, Varanasi Chaukhmbha Sanskrit Sansthana, Page no.109

11. Acharya Kashyap, Kashyap Samhita- "VIDHYOTINI" Hindi commentary by Ayurvedalankar Shri Satyapala Bhisagacharya Khilsthana Ch. 12 Ver. 15 -18 Reprint edition 2012, Varanasi Chaukhambha Prakashan, Page no. 485-486

12. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath

Chaturvedi – Vimanasthana Ch. 8 ver. 122 Reprint edition 2013, Varanasi Chaukhambha Surbharati Academy, page no. 781-782.

13. Available at: https://drive.google.com/file/d/1j3umH5zcJAGNR_WUFwl3-0rBiemYw8DR/view

14. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi –Sutrasthana Ch. 5 ver. 3 Reprint edition 2020, Varanasi Chaukhambha Surbharati Academy, page no. 90.

15. Lönnerdal B. Infant formula and infant nutrition: bioactive proteins of human milk and implications for composition of infant formulas. Am J Clin Nutr. 2014 Mar;99(3):712S-7S. doi: 10.3945/ajcn.113.071993. Epub 2014 Jan 22. PMID: 24452231.

16. Sasikala, Asha. (2019). Complementary Feeding in Infants: An Ayurvedic Overview. 3568-3573. 10.31142/ijahm/v9i4.03.

17. Weydert JA. Vitamin D in Children's Health. Children (Basel). 2014 Sep 12;1(2):208-26. doi: 10.3390/children1020208. PMID: 27417476; PMCID: PMC4928729.

18. Bhatnagar S, Natchu UC. Zinc in child health and disease. Indian J Pediatr. 2004 Nov;71(11):991-5. doi: 10.1007/BF02828114. PMID: 15572819.

19. Daniel E Roth, Stephanie A Richard, Robert E Black, Zinc supplementation for the prevention of acute lower respiratory infection in children in developing countries: meta-analysis and meta-regression of randomized trials, *International Journal of Epidemiology*, Volume 39, Issue 3, June 2010, Pages 795–808, https://doi.org/10.1093/ije/dyp391

20. Available at: https://infs.co.in/blog/2022/01/07/nutritional-requirements-of-infants/

21. Joe M. Braun, Department of Environmental Health, Harvard School of Public Health, Harvard University, Boston, Massachusetts Impact of Early-Life Bisphenol A Exposure on Behaviour and Executive Function in Children.

22. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi –Sutrasthana Ch. 5 ver. 6-13 Reprint edition 2020, Varanasi Chaukhambha Surbharati Academy, page no. 92-94.

23. Acharya Charak, Charak Samhita- "VIDHYOTINI" Hindi commentary by Pandit Kashinath Shastri & Dr. Gorakha Nath Chaturvedi – Vimanasthana Ch. 1 ver. 6, 24 Reprint edition 2020, Varanasi Chaukhambha Surbharati Academy, page no. 598 and 607.