



Review Article

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UNDERNUTRITION IN CHILDREN: AN UPDATED REVIEW

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ABSTRACT

Undernutrition is defined as being underweight for one's age, too short for one's age (stunting), dangerously thin for one's height (wasting) and deficient in vitamins and minerals (micronutrient deficiencies) as an outcome of insufficient food intake, inadequate care and infectious diseases. Undernutrition is widely recognized as a major health problem in the developing countries of the world. Undernutrition affects more than one third of world's children, and nearly 30% of people of all ages in the developing world, making this the most damaging form of malnutrition worldwide. Ayurveda explains the disease Karshya which can be taken as the nutritional deficiency disorder which may be a result of under nutrition or malnutrition. Nutritional deficiency where the weight loss (underweight) is main event can be considered as Karshya. The present article details all the updates regarding undernutrition in children.

Keywords: undernutrition, karshya, stunting, wasting, malnutrition, Ayurveda

INTRODUCTION

The optimal body functions are being maintained by proper nutrition intake by way of energy rich and nutritious food throughout human life.¹ Malnutrition is defined as inadequate nutrition either as undernutrition or over nutrition.² Undernutrition is defined as being underweight for one's age, too short for one's age (stunting), dangerously thin for one's height (wasting) and deficient in vitamins and minerals (micronutrient deficiencies) as an outcome of insufficient food intake, inadequate care and infectious diseases.³ Underweight is a composite form of under-nutrition that includes elements of stunting and wasting and is defined as weight for age below minus two standard deviations from the median weight for age of the standard reference population.⁴ Ayurveda explains the disease Karshya which can be taken as the nutritional deficiency disorder which may be a result of under nutrition or malnutrition.⁵ The word 'Karshya' is derived from the root 'Krish' which means to become lean or to become emaciated.⁶ According to Amarakosha, Krusha means Alpa - decreased body weight and Krushata is the result of Shoshita rasa dhatu causing decrease in Mamsa of the body.⁷ Acharya Dalhana has given the meaning of Atikarshya as the reduction in Upachaya, Rupa, and Bala.⁸ So Karshya can be defined as a condition or disease in which the body of a person becomes emaciated, having less quantity of Rasa Dhatu further causing a status of Mamsahinata or Mamsakshaya.⁹ Dhatukshya is the main event and thus Karshya falls under Apatarpanajanya diseases.¹⁰ There are many nutritional deficiency disorders in which weight loss may not

occur.¹¹ Hence, all nutritional deficiency disorders cannot be correlated with Karshya. Nutritional deficiency where the weight loss (underweight) is main event can be considered as Karshya.

Undernutrition is widely recognized as a major health problem in the developing countries of the world.¹² One third of total child population worldwide is suffering with undernutrition.¹³ As per the prevalence based studies carried out by UNICEF, one out of every four children under five years old children is underweight.¹⁴ Of these children, nearly three quarters live in 10 countries. South Asia has by far the highest levels of underweight, affecting 46 per cent of all under five children in the region.¹⁵ Three countries - India, Bangladesh and Pakistan account for half the world's underweight children.¹⁶ The public attention has always been on child population, amidst all sort of disasters and calamities of every kind.¹⁴ The millions of children losing life by falling to silent emergency of undernutrition have always been out of attention by the international community.¹⁷

Undernutrition at Different Ages

Undernutrition has the most severe consequences from conception until the age of two years and that often cannot be fully reversed which will continue throughout entire life.¹⁸

Unborn and newborn babies: Undernutrition in pregnancy may lead to anemia or infections which can drastically affect the health of the growing fetus. The inadequate diet and nutrition of

the mother is directly responsible for intra-uterine growth retardation and low birth weight in the baby. This gives the baby a bad start thereby escalating mortality and morbidity and thereby retarding its physical, social and intellectual development. Undernutrition in newborn throws the baby at risk of nutrition-related chronic diseases such as cardiovascular disease in later life.¹⁸

Infants and young children: Disorders of breast milk or inadequate breastfeeding are the major causes of undernutrition below the age of six months and is otherwise rare. Under six months, the most important factor for neonate's nutrition is breast-milk.¹⁹ Hence, Acharyas have discussed abnormalities of breast milk well in detail. Among the doshic abnormalities of breast milk, Acharya explains that in Vata dushta stanya, milk becomes tasteless and the child becomes emaciated. He does not relish this type of milk and thus his growth gets impaired. The child gets reduced of his strength because of this milk which is poor in unctuousness.²⁰ Undernutrition is more common between 6-24 months of age since by six months breast milk alone cannot cover a baby's nutrient needs.²¹ Acharya Charaka says that a child taking Pitta dushta stanya will have a warm body always and gets afflicted with anemia and jaundice.²² Acharya Kashyapa also explains a condition, Ksheeraja Phakka which is caused due to the kaphaja vitiation of the breast milk which diminishes the baby's digestive fire, and leads to obstruction of the Rasavaha srotas causing emaciation, weak and withered body resulting in motor function insufficiencies. Qualitative and quantitative reduction in the milk of the mother causes Ksheeraja Phakka in children. Acharya Vagbhata cites a disease called Kumarashosha which is caused due to Kaphaja stanya dushti where the child suffers from anorexia, rhinitis, fever, cough, emaciation and slimy pale appearance of face and eyes. Chakradatta calls this condition as Ahitundika or Ahindika.²³ After six months, the major cause for undernutrition is improper weaning practices and infections. Weaning foods can cover the nutrient needs in infant, only if it is rich in energy. The risk of infection also increases as infants lose immunity acquired from their mothers while still developing their own and also by the start of new foods and drinks, becoming more active and meeting more people thus adding to risk for undernutrition. Growth will be slowed down and infections last longer in an undernourished child. Undernourished children are at high risk of permanently stunted growth and development if left unattended.²⁴ Such an extreme condition has been explained by Acharya Kashyapa called Phakka where the child ends up in severe acute malnutrition ultimately causing motor disability in the child. The deficiencies of vitamin A, iron, zinc and iodine are the common micronutrient deficiencies at this age.²⁵

School-age children and Adolescents: Children who are underweight in early stages of life will continue with hardships of under nutrition in their further period in school.²⁶ They do not attain appropriate weight for age in spite of the fact that at this age they have developed immunity to common infections and, until puberty, have relatively low nutrients needs for body weights and can ask and seek for food. Acharya Yogaratnakara explains Karshya as a similar condition where a child who in spite of having a stable Agni, having good appetite and taking feeds properly; has weakness of the body and does not gain weight appropriately. Lack of nutrients and anemia slow down the process of growth in school children compared to their healthy peers. Children who come from poverty stricken homes perform less in work and play due to hunger. A child who is physically weak will be mentally weak, and cannot be expected to take full advantages of schooling and intervention is most appropriate at this age in order to give health care, nutritional status and well-being of children throughout school years to

transform them into a healthy adult.²⁷ Nutrient needs are at peak during puberty as there is dramatic increase in growth both physically and mentally. Increased incidence of anemia in girls is prevalent at this age due to start of menstruation.

Etiology of Undernutrition²⁸

Infants and children are particularly susceptible to undernutrition because of their high demand for energy and essential nutrients. We can divide the causes of undernutrition into immediate, underlying and basic.²⁹

Immediate causes are poor diet and affliction by diseases. Qualitative and quantitative reduction in the breast milk of the mother is the main cause in infants.³⁰ Doshic disorders of breast milk explained by Acharyas such as Vataja, Pittaja or Kaphaja is an immediate cause for undernutrition in infancy. Any pathology pertaining to gastrointestinal diseases or respiratory disorders exacerbate as the immediate causes of undernutrition. Diseases like intestinal malabsorption (celiac disease, tropical sprue, cystic fibrosis etc.) tuberculosis, intestinal parasitic infestations, diabetes, galactosemia and other metabolic disorders often end up secondary malnutrition. Inadequately fed infants and children are at risk of protein-energy undernutrition (PEU - previously called protein energy malnutrition - PEM) and deficiencies of iron, folate (folic acid), vitamins A and C, copper, and zinc. Features suggestive of severe dehydration which leads to non-absorption of vitamins from the gut causing deficiencies especially Vitamin A deficiency (VAD) has been mentioned in affliction of child by Andhapootana Graha which presents with vomiting, fever, cough, diarrhea, emaciation, eye disorders (dryness, dimness of vision and inflammation), aversion to breast milk, discoloration of skin, shrilled cry and bad fishy odour of body.

Underlying causes are faulty food habits, family food insecurity, unhygienic living conditions, inadequate health services, closely-spaced families and a working mother.³¹ Decline in the good practice of breastfeeding by ignorant mothers have led to widespread practice of artificial feeding, providing diluted and most often, dirty formula feed contributing considerably to malnutrition. Faulty food habits like fast foods and nutrient poor foods like pizzas, burgers, oodles and chocolates also play an important role in undernutrition in young children.³² Aharaja Nidan as like Ruksha Annapana Sevana (indulgence in rough food and drinks), Langhana (fasting), Alpashana, Pramitashana and Anashana (little diet), Vatika Annapana (diet that aggravates Vata - Kashaya, Katu, Tikta Rasa). In closely spaced families when pregnancies occur rapidly, perhaps every year or every other year, incidence of undernutrition is much higher.³³ This scenario where the child becomes emaciated due to non-feeding at the breast because of a second growing fetus inside the mother has been elaborated by Acharya Vagbhata as Parigarbhika. The word "Paribhava" means to 'humiliate or disrespect', and "Parigarbhika" means 'humiliated by Garbha' indicating disregarded child consequent to next pregnancy. The vitiated Stanya of pregnant mother diminishes the Agni of the child causing Dhatu Dushti and vitiation of Kapha Dosha with features such as anorexia, poor digestive fire, vomiting, abdominal distension, emaciation and drowsiness. Garbhaja Phakka mentioned by Acharya Kashyapa is also caused when the nutritive value of the mother's breast milk reduces (due to a second pregnancy or undernutrition of the mother herself) and the child is early weaned from the breast causing Dhatu Kshaya, e, emaciation, and arrests normal growth and development of the child. The disease advances to such a stage that the child is crippled due to malnutrition. The reference of Sandashi Jataharini is also seen in Kashyapa Samhita which is

similar to Parigarbhika, where Karshya is found as an early symptom.³⁴ The incidence of malnourished children is also seen to be higher where mothers are daily laborers who find little time to take care of child 's feeding and rearing.³⁵ More often than not - "mothering" is done by an elder sibling which is also an underlying cause of undernutrition.

Basic causes of undernutrition like poverty, starvation, political and economic insecurity, war, and/or natural disasters. The undernutrition which begins with these factors often dip into severe malnutrition due to unavailability of proper treatment and care. In most situations, children's baseline nutrition is poor even before the crisis exacerbates such factors as food insecurity, limited access to essential health services, unhealthy environments, and poor feeding and care practices. As a result, the restricted nutritional stores of children are soon depleted subsequent to emergencies.³⁶ Acharya Kashyapa explains Phakka as a disease that afflicts the Anaatha (child who is abandoned) who ends up in nutritional disorder with features such as emaciated hips and arms, decrease in muscle, strength and luster, protuberant abdomen, prominent bony protuberances, crawls on hands and knees due to inability to stand and walk, passes too much urine and stool, dry hairs, long nails, foul smell, irritable and thick nasal discharge; where along with nutritional deficiency there is motor and mental developmental delay in the child.

Apart from these some of the causes responsible for causing undernutrition has been elaborated in Ayurveda. Some activities like Kriyatiyoga (Excessive subjection to evacuative therapy), Atishrama, Atimaithuna, Atisnanaabhyasa (Excessive exercise, sexual intercourse, excess bath), Rukshaudvartana, Rukshasnana (Excess nonunctuous anointing to the persons), Atiadhyanana (excessive studying), Vataatapsevana (excessive exposure to sun and wind), Kapha, Shonita, Malaativartana (excessive excretion of kapha, blood and stools), Dukhasayya, Dukha asana (improper sleeping and sitting positions for long periods of time), Balavatanigraha and Atibhargamana has been mentioned to cause Karshya. Some mental functions like Shoka (grief), Chinta (worries), Bhaya (fear), Shrama (excessive physical and mental activity), Krodha (anger) and Vega-Nidra-Trusha-Kshudha-nigraha (suppression of natural urges such as sleep, thirst and hunger). However, these causes of Karshya are seldom seen in children.

Acharyas have emphasized that some physiological conditions where Krushtha may pertain such as the Prakruti (constitution), Beejadoshha (heredity), Jara (old age), Vikara-anushaya (continued disorder), Grishma rtu (summer season) and also by Bhutabhighata (affliction of bhutaja disorders). One of the mentionable Graha which finds its place in disorders of Karshya is the Sushkarevati Graha where emaciation is the characteristic feature. The child becomes emaciated even though he consumes food; he suffers from severe thirst and has shriveled eyes. Features like falling of hairs, hatredness to food and feeble voice are present. Further manifestations of systemic symptoms such as nodules around the abdomen and foul smell of body and feces are explained.³⁷

Classification of undernutrition

Based on clinical classification undernutrition (or underweight) has been defined as when the child is malnourished, but does not have any feature of marasmus or kwashiorkor and the weight for age is 60-80% of the expected.³⁸

Based on anthropometrical classification, Indian Academy of Pediatrics classifies undernutrition as Grade I (70 -80% of

expected weight) and Grade II (60 -70% of expected weight).³⁹ Acharyas explained features of various degrees of undernutrition as Shushka-Sphic, Udara, Greeva (emaciation of buttocks, abdomen and neck), Dhamanijalasantataha (Prominent vascular network), Twagasthishesho (Remnant of skin and bone), Sthoolaparva (Thick nodes), Vyayamumatisauhityam (inability to tolerate physical exercise), Kshutpipasamaya-aushadhamatisauhityam (inability to tolerate hunger, thirst, disease, drugs), Ati-shitoshna-maithunam (inability to tolerate excessive cold, heat and sexual intercourse) and Pleehavruddhi (spleen enlargement). The symptoms explained by Acharya coincides more with severe degrees of malnutrition and can be appreciated better in chronic conditions.

Etiopathogenesis of Undernutrition

Undernutrition can result from inadequate ingestion of nutrients, malabsorption, impaired metabolism, loss of nutrients due to diarrhea, or increased nutritional requirements (as occurs in cancer or infection).⁴⁰ Undernutrition progresses in stages; it may develop slowly when it is due to anorexia or very rapidly, as sometimes occurs when it is due to rapidly progressive cancer-related cachexia.⁴¹ First, nutrient levels in blood and tissues change, followed by intracellular changes in biochemical functions and structure.⁴¹ Ultimately, symptoms and signs appear. Diagnosis is by history, physical examination, body composition analysis (see Body composition analysis), and sometimes laboratory tests (e.g. albumin).⁴¹ According to Ayurveda, the indulgence in the etiological factors results in the vitiation of Vata Dosha by virtue of its Ruksha Guna. Vata, Agni and Rasa are interrelated. Vitiation of Vata leads to Agni Dushti and this leads to Vata Prakopa. At this juncture either of them depreciates the quantity and unctuousness of the nourishing Rasa Dhatu which in turn adversely affects the circulation of Rasa Dhatu in the body. This hampers the proper nourishment of the remaining Dhatus, which leads to Dhatu Kshaya and ultimately manifests as Karshya. Here, first Kshaya of circulating Rasa Dhatus occurs which leads to the less nutritional supply to the other Dhatus leading to the depletion and ultimately resulting is Krishata. According to Acharya Sushruta, due to Nidana Sevana, the Rasa Dhatu which gets formed will be less in quantity and Ruksha in nature which does not provide adequate nourishment to the other Dhatus, thus leading to the manifestation of Karshya.

Management principles of undernutrition

Following evaluation of the child's nutritional status and identification of the underlying etiology of the malnutrition, dietary intervention in collaboration with a dietitian or other nutritional professionals should be initiated.⁴² The goals of treatment are to minimize weight loss, to maintain body mass, to encourage body mass repletion. The principles of treatment are:

- 1) Treatment of complication - by careful surveillance and prompt remedial action and by treating primary cause.
- 2) Initiation of feeding - by all available means which are locally available and culturally acceptable. To achieve appropriate weight gain, 120-150 kcal/kg/d is needed in children with chronic history. The formula for determining adequate caloric intake is: $\text{Kcal/kg} = (\text{RDA for age} \times \text{ideal weight})/\text{actual weight}$
- 3) Catch up growth and rehabilitation - Additionally, any micronutrient deficiencies have to be corrected for the child to achieve proper growth and development. The children with mild undernutrition respond to increased oral caloric intake and supplementation with vitamin, iron and folate supplements. The requirement for increased protein is met by increased food intake rich in protein and calories. The

sufficiency of intake is determined by assessing the weight gain.

- 4) Follow up care - To prevent further relapse, monitor patients closely for growth and resolution of problem.

Ayurveda follows a more holistic approach to the management of Karshya. Karshya being a Vata Pradhana Vyadhi, mainly occurring due to Dhatu Kshaya the general line of treatment i.e. Vata Upakrama can be adopted. As specific line of treatment all Acharyas have observed the importance of Brimhana therapy. According to Acharya Charaka, Brimhana therapy should be Laghu Santarpana in nature. Because in a Krishna patient Agni, Sharira bala and other related aspects are functioning poorly. Acharya Sushruta described that proper application of Samshodhana, Samshamana Aahara and Achara are helpful in preventing, controlling as well as eradicating the disease. The principle of management of Karshya should be in following manner:

- 1) Nidana Parivarjana
- 2) Agnisthapana by Deepana-Pachana
- 3) Samshodhana
- 4) Samshamana by Rasayana⁴³

Nidana Parivarjana:⁴⁴ In Karshya, Nidana Parivarjana is the first line of treatment. Here the Nidanans like Ruksha Annapana, Vatika Annapana, Alpa Bhojana, Kashaya, Katu, Tikta Rasa Sevana, Ati Vyavaya etc. should be avoided. Nidana Parivarjana has two fold benefits - as a prophylactic measure, further progression of disease will be halted and future relapse of the same disease can be prevented.

Agni Deepana:⁴⁵ In Karshya, the first line of Samshamana Chikitsa is to improve the proper functioning of Agni through the Aushadhis, Pathya Ahara and Vyayama.

Pachana:⁴⁶ In Samprapti of Karshya it can be seen that the Ama has an important role in the manifestation of the disease. So to treat Karshya, the prerequisite is to adopt Ama Pachana Chikitsa. Pachana Dravyas like Shunti can be administered.

Samshodhana: Karshya being an Apatarpanajanya Vyadhi, Brimhana therapy is indicated. But Mridu Samshodhana can be advised to the Krishna patient.⁴⁷ Samshodhana therapy is of two types

- i) Bahir Parimarjana
- ii) Antaha Parimarjana

Bahir Parimarjana can be obtained through Taila Abhyanga and Snigdha Udwartana which are indicated in Krishna patient.

Antaha Parimarjana - In the context of Atikarshya, Acharya Charaka says that Doshavasechana should be performed. Acharya Sushruta and Vagabhata recommend Brimhana Basti having Mridu, Snigdha properties to be given in Karshya.⁴⁸

Samshamana:⁴⁹ Shamana therapy is conservative treatment. It is mainly employed in the form of drug treatment according to severity of disease as well as the condition of the Rogi. Some examples of Samshamana drugs are AswgandhaChurna,⁵⁰⁻⁵³ Aswgandha ghrita,⁵⁴ Karshyahara yoga⁵⁵ etc.

Rasayana:⁵⁶ Acharyas opines that Rasayana, Balya, Brimhaniya, Jeevaniya type of drugs should be administered specially the drugs belonging to Madhura Skanda, along with that Aswgandha,⁵⁷ Vidarikanda, Shatavari, Bala, Atibala, Nagabala etc. are recommended by Acharya Sushruta.

CONCLUSION

Undernutrition being one of the major health problems in the world has been on and over studied and understood with an intention to mitigating it, but the understanding of this disease in terms of Ayurveda and the wide range of treatment that can be offered is still not explored and experimented. There is an immediate necessity of meticulous research in this stream in collaboration with Ayurveda so that the world is ridden of the burden of sick and weak children.

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