

Need and Significance of an Ayurvedic Ready to Use Therapeutic Food (RUTF) in Children of Under 5 years Age: A Review

Running Title: Ayurvedic RUTF for malnutrition

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Abstract

Severe acute malnutrition is defined by a very low weight for height (below -3z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema. As per NFHS 4 report, 7.5% of the under 5 children are severely wasted, 38.4 % are stunted and 35.7% are underweight. The WHO protocol for management of SAM includes in-patient treatment and community interventions which are considered to be effective and have greater significance in reducing the mortality of affected group. These programs include usage of ready-to-use-therapeutic-foods (RUTF) customized and tailor-made to suit the needs of deficient energy and protein. All patients who do not have complications and hence do not need in-patient management are treated with RUTFs. An ideal RUTF should replenish the energy and protein stores, should be composed of locally available and cheaper ingredients, suitable to blend with the normal household food pattern and palatable. Conventional RUTFs contains milk powder, sugar, peanut butter, corn soya blend etc. Due to high chances of instability of milk products, search for alternative, stable, cost effective and regional products is going on. As far as India is concerned, the malnutrition map is highly confined to rural and suburban areas which relies upon “desi dawayi”/ indigenous medicines. The apprehensive approach to modern methods makes them vulnerable to preventable ill fate of malnutrition. In this background, the scope of an Ayurvedic RUTF cannot be undermined, which can serve the purpose of supporting their nutritional needs without disturbing the local culinary tradition and mindset. A properly studied, safely manufactured, palatable Ayurvedic RUTF is hence need of the hour. Ayurveda offers a range of *prinana modakas* to tackle the issue. The mode of action is based on enhancement of general appetite and increasing the food uptake and simultaneous supplementation of energy. This review aims at exploring the possibilities in developing a stable Ayurvedic RUTF.

Key Words: Severe Acute Malnutrition, RUTF, Ayurveda, Prinana modaka

Introduction

SAM (Severe Acute Malnutrition) is a major morbidity factor of children less than 5 years of age and by all means is eligible to be counted as a national concern. It is diagnosed when the child has any one of the following criteria: weight for height (W/H) Z score < -3 SD, Mid upper arm circumference (MUAC < 115 mm, bipedal oedema or visible severe wasting [1]. According to National Family Health Survey 4 (NFHS 4), 7.5% of the under 5 children are severely wasted, 38.4 % are stunted and 35.7% are underweight [2].

Whereas acute cases with complications require institutional care; uncomplicated cases where appetite is retained, is managed by community based nutrition programme. Screening of SAM cases among this age group, giving energy dense Ready To Use Therapeutic Food (RUTF) in therapeutic doses for short term, through community outreach programme, till they recover normal growth status and appetite level, is the most plausible solution [3].

Most of the evidence obtained from studies involving use of RUTFs are generated from African subcontinent [4]. Though Asian [5] countries also had employed RUTFs for tackling SAM, more indigenous, culturally acceptable and locally manufactured formulas should be evaluated to generate ample evidence for developing an effective remedy. Ayurveda, the traditional Indian medical practice, is a valuable source of such nutritional alternatives, especially as its theoretical framework stresses on right nutrition as the key goal for a healthy life [6].

Ayurveda has effective RUTF options that are not known widely. This short review article tries to explore all the possibilities and challenges involved in figuring out a safe, cost effective and palatable Ayurvedic RUTF.

Conceptualization

Ayurveda hypothesises the symptom of under nutrition as 'Karshya'. *Karshya* is an *Apatarpana Janya Vyadhi* (diseases arising due to malnutrition), so its management is to be done by using *Santarpana* (proper nourishing) or *Brumhana Chikitsa*. *Brumhana* refers to the phenomenon of healthy growth of the body tissues with respect to the normal growth parameters. This nourishment can be achieved through either medicine or food or both. Of these, medicine plays better role in enhancing the metabolism and thereby aiding nutrition. There exists a general rule that medicines meant to improve nutritional process should enhance appetite and should be carminative and light in texture, as the persons who will need nourishment will be emaciated with suboptimal digestive and assimilative capacity. Ayurveda corrects the digestive capacity of the individual and make the body fit to absorb nutrients along with supplementation of deficient nutrients. Deworming medicines and doing procedure with such properties are also beneficial.

Feasibility

How feasible is an Ayurvedic therapeutic preparation as an effective RUTF?

Main consideration is the **UNICEF specification of RUTF composition:**

- Ready to use: no cooking/mixing/dilution required
- Storage conditions: no refrigeration required
- Texture: smooth, uniform paste with small particle size ,no grittiness, no lumps no oil separation , easy too squeeze out of the sachet

Contents of RUTF

- Milk: $>50\%$ proteins from milk/dairy products Acceptable sources of dairy protein: Skimmed

milk powder / Full cream milk powder

- Whey protein powder
- Peanut or peanut paste
- Oil: edible refined vegetable oil
- Carbohydrates (sweetener): Lactose & glucose polymers - Lactose / Sucrose Maltodextrine / Fructose / Precooked and/or gelatinised starches.
- No honey (risk of Clostridium botulinum toxicity)

** It should be Soluble & easily absorbed by patients with SAM.

** Added minerals water-soluble & shall not form insoluble components when mixed together.

** Mineral composition shall not alter the acid-base metabolism of patients with SAM: moderate positive non-metabolisable base sufficient to eliminate the risk of metabolic acidosis [10].

Appropriating the RUTF format into ayurvedic context:

- Specifications can be incorporated into Ayurvedic format but not purely as a food supplement, but as a medical formulation. The idea needs to be explored keeping in mind about the peculiarities of Ayurvedic medicines. They are mostly crude preparations containing multiple contents in various proportions. Their mode of action is assumed greatly through the effect. It is not based on the isolation of a particular active principle. As suggested in the composition of RUTF, milk powder based products are rare and against the principles and practice. Alternate sources of energy like cereals and pulses along with drugs that enhance the bio-availability and taste and appetite are prescribed in various therapeutic formulations.

- Ayurvedic prescriptions basically apply certain variable check list before prescribing a medicine and fixing its dose, like age, constitution, disease intensity, appetite, bowel frequency and pattern, physical activeness etc. Therefore, a fixed dose for a targeted population might be difficult to assume. Rather a flexible dose format which goes hand in hand with the principles of Ayurveda would be preferable.
- Ayurveda is considered the traditional Indian medical system. Therefore, the level of apprehension associated with the intake of medicine which is persistent among the rural, poor informed population might be less. Adding to that, the jaggery medium used in Ayurvedic medicinal preparations is quite familiar in their culinary culture.
- Modaka by default contain rich carbohydrate and protein content like sugar, jaggery and ghee. Many of them are advised to be used along with milk supported by the concept of Anupana [11].
- Anupana is defined as the liquid medium ingested together with medicine or food which is supposed to promote absorption and action of the same. Most common Anupanas are lukewarm water, milk, honey, buttermilk, fermented drinks etc. [12] In case of nutritive supplements the commonest instructed Anupana is milk.
- The socio-economic class that presents with undernourished children are mostly not capable of providing milk on a daily basis which in the first case is the reason behind their poor nutrition. These issues can be solved effectively if the interventions are dispensed through an ICDS outlet [13].

Ayurvedic RUTF-Options

There are therapeutic medicinal and therapeutic food preparations in Ayurveda. *Modaka/leha/vataka* [7] is a certain category which is prepared using high contents of 'ghee' and jaggery added with medicinal powders during different levels of preparation. Most of them aim at supplementation of energy in a disease debilitated stage. There are instructions to use them along with food or take in an amount capable of replacing a meal.

PRINANA MODAKAS:

They are designed to aid in nutritive needs of children. The word *prinana* means appeasement or to please. The drugs are entitled to have nourishing, satisfying qualities, and hence the name. They provide nutrition, enhance appetite and promote immunity [8].

They are prepared by adding powdered raw drugs in the medium of melted jaggery or sugar mixed with 'ghee'. Mostly the added drugs increase appetite and improve bio availability of the formulation. In pediatric cases, these are used as weaning foods and supplements.

Basic Ingredients of Ayurvedic RUTF

Ingredients of *Prinana modaka* were: *Priyal Bija Majja* (*Buchanania latifolia*), *Laja*, *Yashtimadhu* (*Glycyrrhiza glabra*), sugar candy and Honey. **Ingredients of *Godhumadi Modaka*** were : Whole Wheat, Bengal Gram, Ground Nut and ^[SEP]Jaggery. **Ingredients of *Balya biscuit***: *Mudga* (green gram) *Amalaki* (*Emblica officinalis*), *Madhuyashti* (liquorice) *Mandukaparni* (*Centella asiatica*), *Guduchi* (*Tinospora cordifolia*), *Atibala* (*Abutilon indicum*), *Dry Kharjoora* (*Phoenix dactylifera*), *Shunthi* (*Zingiber officinale*), *Pravala* (coral), *Mandura* (Ferric Oxide), *Sugar*.

Impact of Ayurvedic RUTF Options on Malnutrition

Many studies have been conducted on the efficacy of *modakas* and similar formulations in managing nutritional deficits and improving weight gain [9]. Most studies done in malnutrition were meant to evaluate the efficacy of nutritive supplements in increasing body mass. Mainly two types of preparations were tested. *Modaka* and medicated enema (*basti*). *Basti* is out of the scope of this review. Among the studies, *Sivamodaka* of the Prem Prakash Vyas study exhibited the highest efficacy in increasing body weight statistically.

Prinana Modaka was used in two studies and *Godhumadi modaka* in one. In both studies, the sample size was small and hence the results cannot be considered statistically significant. In Nirali Joshi study, 2011, using *Prinana Modaka* and *Godhumadi modaka* conducted in 10 & 11 children in 2 groups, the mean weight gain was 5.56 and 6.73 respectively. The Sandip Lad et al study (2015) which used *Prinana modaka* and *Balya biscuit* respectively in two groups comprising of 20 and 22 children showed a mean weight gain of 5.3 and 6.73 respectively.

Though the *balya* biscuit exhibited a better performance in terms of mean weight gain, the presence of elements like Iron and Calcium in crude form makes the product fall under sceptical shadow of heavy metal toxicity.

The above said studies suggest that locally available and culturally acceptable products were used as complementary feeds and they had been found efficient, though a statistically significant result is still being awaited.

Table 1: Previous studies in Ayurveda in Undernutrition:

Serial no:	Study	Group	Sample size	Mean wt ↑
1	Patel et al (1985)	Brimhana yoga	42	7.27
		Lajadi yoga	52	1.49
2	Chaman Lal Sarma (1987)	Brimhana yoga	55	10.83
		Lajadi yoga	48	1.57
3	Prem Prakash Vyas (1991)	Sivamodaka	12	35.06
		Yapana vasti	12	33.44
4	Nivedita S. Kinalekar(1998)	Matrustanya vasti	6	26.55
		Aswagandha kshiravasti	14	6.41
5	Virendra Kumar Kori (1999)	Aswagandha kshiravasti	15	8.03
		Aswagandha granules.	10	5.29
6	Geeta jadav (2003)	Vidarikandadi vati	20	6.63
		Kshirabala taila vasti	17	10.7
7	Nirali Joshi (2011)	Prinana modaka	10	5.56
		Godhumadi modaka	11	6.73
8	Sandip Lad(2015)	Prinana modaka	20	5.3
		Balya biscuit	22	6.73

Challenges

Shelf life: Classically prepared churna (powders),vataka and modaka claims a shelf life of 2 months [14]. Manufacturing and dispensing and intake should happen within the time frame. Addition of preservatives may be employed to increase the shelf life. Shelf-life defined for Churna according to Rule 161-B, Drugs and Cosmetics Act is 2 years. Stability study is essential to impart evidence on how quality of a drug differs with time under influence of variety of environmental factors such as, temperature, humidity and light [15].

Moisture content: Controlling moisture content in the finished product and checking fungal growth can be solved by using air tight containers which is packed in size adjusted sachets. This aids in dispensing too.

Heavy metal toxicity: Often, Ayurvedic medicines incorporate various minerals and metals into their formulations. They are supposed to undergo Sodhana/ purification therapies suggested in the context. Even though, on further evaluation, many of them exhibit heavy metal contents exceeding the permissible limits [16]. Strict monitoring and adherence to GMP guidelines for AYUSH drugs can assure safety.

Dose fixing:

All the medicines for pediatric age group is age and purpose specific. (Table 2) Additional to age, the appetite and potency of drug are considered [17].

Age Group	Dose	Amount
Immediately after birth	Badariphala beeja tulya (seed of jujube fruit)	125mg
5 -10 days	Slightly increased	
10-20 days	Equal to ½ Badaripahala (jujube fruit)	0.5g
1 month	Equal to 1 Badariphala (jujube fruit)	1g
1-2 months	1½ Badariphala (jujube fruit)	1.5g
3 months	3 Badariphala (jujube fruit)	3g
4 months	Equal to dry Amalaki fruit (amla)	3g
5-6 months	Equals to wet Amalaki fruit (amla)	4g
7-8 months	More than Amalaki (amla)	5g
Kṣīrāda (upto 1 year) Child	Amount held on terminal phalanx of index finger	
Kṣīrānnāda (1-2 years) Child	Equal to seed of plum fruit (Kolāṣṭhi)	
Annāda (> 2 years) Child	Equal to plum fruit (Kola)	6g

Conclusion

Considering the gravity of malnutrition as a growing concern in the nation despite all measures undertaken by the Government to improve the nutritional status of the children, new safe and cost effective, indigenous ready to use therapeutic foods should be manufactured. Ayurveda's rich pool of empirically proven formulations can be evaluated scientifically for serving the purpose. The philosophy involved in that is to aid the body in gaining optimum appetite and thereby promoting adequate uptake and absorption of macro and micro-nutrients and maintain a steady growth pattern. The trials conducted in field, so far has put forward a couple of effective formulations named "modakas" which is the combination of food and medicine.

Once the concerns regarding shelf life, heavy metal toxicity, calorie value, dose and content specification as per UNICEF guidelines had been properly addressed, the concept of Ayurvedic RUTF can be considered feasible.

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