FROM FARM TO TABLE:

HOW MILLETS CAN TRANSFORM THE FUTURE OF THERAPEUTIC NUTRITION

Shreya*[1], Arjoo[2] and Rajat[3]
[1]Department of Genetics and Plant Breeding, CCS HAU, Hisar
[2]Department of Horticulture, MHU, Karnal
[3]Department of Horticulture, CCS HAU, Hisar

E-NAM WORK

Malnutrition is a pressing issue in India that has been a cause of concern for decades. Despite the country's rapid economic growth and improvements in healthcare, malnutrition continues to affect a significant portion of the population, particularly among children under five years of age. A more intense manifestation of malnutrition is Severe Acute Malnutrition (SAM), commonly referred to as 'Wasting Disease', characterized by low weight-for-height ratio. India is ranked at the bottom of the Global Hunger Index (2022), which is determined by factors such as child stunting, wasting and death, placing India on 107th rank among 121 countries. In this context, addressing malnutrition remains a critical challenge for India's policymakers, healthcare professionals and civil society. In order to promote nutrition among children, pregnant women and nursing moms, Government of India established the POSHAN Abhiyaan in 2017. With a view to attain the second Sustainable Development Goal (SDG), which is to eradicate hunger and achieve food security and enhanced nutrition, a number of anganwadis were given the responsibility to organize Supplementary Nutrition Feeding for infants, pregnant women and nursing mothers. From 2006 to 2021, on account of such measures, the prevalence of stunting, underweight and wasting decreased by 12.3, 10.3 and 0.7 percentage points, respectively. However, resource-deprived areas with low per capita income continue to face the most severe stage of this problem, and it is imperative for the government to intervene and eliminate it entirely. One such miraculous intervention is Ready-to-eat-therapeutic-food (RUTF), invented in 1996 by French pediatrician André Briend.

WHAT ARE RUTF?

RUTF is a UNICEF recommended tactic to address the problem of SAM. These are 'energy-dense, micronutrient-enriched food items which are soft or crushable or drinkable foods and can be directly given to patient without cooking'. The globally recognized RUTF, Plumpy'nut®, having peanut as a major ingredient, is aptly serving the purpose in Sudan, Kenya, Niger and other African countries. It is a paste of peanuts, sugar, oil and milk powder and it can be consumed directly from the sachets it is packed in with or without mixing with milk to lower chances of contamination, providing a kind of instant solution for malnutrition.

eNAM
Uttam Fasal Uttam Enaam

NATIONAL AGRICULTURE MARKET

IDEAL CHARACTERISTICS OF A RUTF:

Numerous researchers have since directed their attention towards identifying improved alternatives to RUTF, highlighting several key characteristics that must be present for a food item to be classified as RUTF, as mentioned here:

1. Storage conditions: no refrigeration required
2. Texture: smooth, uniform
3. Appearance: paste/powder
4. Particle size < 200 microns
5. No grittiness
6. No lumps
7. No oil separation
8. Easy to squeeze out of the sachet
9. Color: light brown to cream
10. Free from pesticides & mycotoxins.

Eventually, alternative RUTF formulations have been proposed and are based on four main ingredients: a carbohydrate source (cereal or millet), a protein source that can be of vegetal origin (beans, legumes, etc.) or animal origin (milk, red or white meat, fish meat, egg, etc.), a mineral and vitamin supplement (derived from vegetal, fruits or a mixture of both) and an energetic supplement (e.g., lipids, oil, sugar, etc.). Moreover, the proposed foods should have an optimal physical characteristic of being soft in consistency, easy to swallow and suitable for infant feeding.

Quality control (QC) is achieved by adopting standard operating procedures that are accepted internationally as the standards for production of food, the Hazard Analysis Critical Control Point (HACCP) and the Codex Alimentarius Program. These procedures prescribe storage of ingredients, raw material procurement, mixing of ingredients and the storage of finished products.

WHY MILLETS?

In India, millets have emerged as an excellent alternative for preparation of RUTF. Millets are nutritionally equivalent to or even superior to several of the most important cereal grains.

Millets belong to the family Poaceae, which can grow well under dry, high-temperature conditions as grasses with small seeds and have been used as food, feed and fodder for around 10,000 years. They are broadly categorized into two major groups:

A. Major Millets:

i. Pearl millet or bajra (*Pennisetum glaucum*)
ii. Sorghum or jowar (*Sorghum bicolor*)

B. Minor Millet:

i. Finger Millet or ragi, mandua (*Eleusine coracana*)
ii. Barnyard millet or jhangora, sanwa (*Echinochloa frumentacea*)
iii. Little millet or kutki, shavan (*Panicum sumatrense*)
iv. Foxtail millet or kangni, kakum (*Setaria italica*)
v. Proso millet or barri (*Panicum miliaceum*)
vi. Kodo millet or koden (*Paspalum scrobiculatum*)

Considering the nutritional profile of these small-seeded crops, these are full of physiologically active substances and provide numerous health benefits, including a high antioxidant content, high fiber content, low glycemic index, gluten-free protein and other essential vitamins & minerals. Nutrient content of few important millets is given in Table 1.

Table 1. Nutrient content in important millet crops-

Millets	Foxtail	Little	Barnyard	Kodo	Proso	Pearl	Finger
Protein (g/100g)	11.02	9.44	10.45	9.07	12.61	11.86	7.41
Fat (g/100g)	4.01	3.72	3.5	3.22	3.08	4.28	1.71
Fe (mg/100g)	2.64	1.43	5.07	1.17	0.92	6.85	4.82
Zn (mg/100g)	2.43	3.61	2.13	1.62	1.38	2.82	2.45
Ca (mg/100g)	34.19	17.17	22.31	14.58	13.41	24.93	350.33
Mn (mg/100g)	0.44	0.32	1.1	0.47	1.25	1.6	3.86
Cu (mg/100g)	0.2	0.38	0.34	0.27	0.47	0.54	0.69

Millets have gained recognition for their suitability in RUTF production not only because of their nutritional value but also for their ability to grow with minimal inputs, making them accessible in regions with poor soil and water conditions. Such regions have higher proportion of inhabitants suffering from malnutrition. Most of them possess therapeutic properties that can positively impact the health and well-being of their users (Table 2). Furthermore, in comparison with wheat and rice, millets contain several times more minerals (1–5 g/100 g). There is an abundance of iron in Pearl Millet and Barnyard Millet, which can fulfill the iron requirement of anemic individuals. There is a high content of zinc (4.1 mg/100 g) in foxtail millet, as well as a high content of iron. By virtue of their explicit nutrient content, these foods are regarded as Complete Food or Super Food, as their inclusion in regular meals can provide significant nutritional benefits.

Table 2. Therapeutic features of important millet crops grown in India

Millet Type	Therapeutic Features
Foxtail millet	Reduces risk of colon cancer. Lessen cholesterol and possesses anti-diabetic capability. Attenuates ethanol-induced hepatic damage.
Pearl millet	Gluten-free property averts celiac disease. The immune system improves by inhibiting pathogenicity induced by Shigella.
Finger millet	Reduces damage to soft tissue and facilitates the healing process. Reduces plasma triglycerides, thus reducing the risk of cardiovascular disease.
Kodo millet	Minimize glycemic index and diabetes occurrence, and have antioxidant actions as well.
Proso millet	Celiac disease can be prevented due to gluten-free properties. Being a low-glycemic index (GI) food reduces type 2 diabetes risks.
Little millet	Polyphenol content helps to prevent various metabolic disorders.
Barnyard millet	Damaging apoptotic cells reduces colorectal cancer risk. Inhibits protein glycation and glycoxidation, which improves the state of diabetes.

CONCLUSION:

As specified by Manuel Fontaine, UNICEF Director of Emergency Programs, 'Malnutrition is a silent threat to millions of children. The damage it does can be irreversible, robbing children of their mental and physical potential. In its worst form, severe malnutrition can be deadly', it is clear that the problem needs to be addressed on prior basis without any neglect.

Poverty and food insecurity seriously constrain accessibility of nutritious diets, including high protein quality, adequate micronutrient content and bioavailability, macro-minerals and essential fatty acids, low anti-nutrient content and high nutrient density. Largely plant-source-based diets with few animals' source is unable to keep pace with the daily requirements of a severely malnourished individual. Consequently, the emergence of innovations like RUTF plays a significant role in addressing the problem effectively. Given the nutritional, environmental and economic advantages of millets over the most prevalent staple grains, they present a compelling choice to be utilized as a fundamental ingredient in RUTF. Continuous efforts must be made to improve the millet germplasm, with enhanced nutrient use efficiency, bioavailability of nutrient and an extended shelf life, expanding their utility as RUTF ingredient.

Upon these considerations it was felt that millets based RUTF represented an important opportunity for a multi-faceted, holistic effort to reverse the situation, with benefits to farmer status, empowerment and income (especially for women), to conservation, to nutrition, to the environment and ultimately to food and nutritional security.