

Ready to Use Therapeutic Food (RUTF): An Overview

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Abstract:

Therapeutic foods are foods designed for specific, usually nutritional, therapeutic purposes as a form of dietary supplement. The primary examples of therapeutic foods are used for emergency feeding of malnourished children or to supplement the diets of persons with special nutrition requirements, such as the elderly. Ready-to-Use Therapeutic Food (RUTF) is a mixture of nutrients designed and primarily addressed to the therapy of the severe acute malnutrition without complications. The recent success of home-based therapy has been seen in conjunction with the availability of a novel food, a spread form of ready-to-use therapeutic food (RUTF). The main ingredients of the formulation are powdered milk, peanuts butter, vegetal oil, sugar, and a mix of vitamins, salts, and minerals. The effectiveness of ready to use therapeutic food within the person's own home for the treatment of severe acute malnutrition in children under five years of age has been found not to be different than standard care. In this review article we have enlighten on complete formulation, its components, various types, alternative available, clinical studies, challenges and opportunities of RUTF for the treatment of severe acute malnutrition. This formulation is a need of low income countries and developing countries to combat malnutrition of childrens.

Keywords:

RUTF; Types; Components; Manufacturing; Malnutrition;

1. INTRODUCTION

1.1 Malnutrition

Malnutrition literally means “bad nutrition” and technically includes both over and under nutrition. In the context of developing countries, under-nutrition is generally the main issue of concern, though industrialization the changes in eating habits have increased the prevalence of over-nutrition. WFP defines malnutrition as “a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate performance process such as growth, pregnancy, lactation, physical work and resisting and recovering from disease.” [1, 2]. It classified as shown in **Table 1** [2]. Severe acute malnutrition is critical health problem in under-five aged children in all over world. Globally, an estimated 20 million children are suffering from Severe Acute Malnutrition (SAM). In India about 8.1 million children with severe acute malnutrition(SAM)according to the National Family Health Survey (NFHS) [3].

Currently available facilities for hospitalized care of children in India would be inadequate even if they were utilized exclusively for the treatment and rehabilitation of children with SAM. Limitations in availability as well as access to facility based care, therefore, make community management of SAM a priority. Small hospitals and facilities where children hospitalized with SAM are managed often lack kitchens where recommended diets to rehabilitate these children can be hygienically prepared every day. A ready to use therapeutic food (RUTF) product that can be administered to children with SAM in their homes or in small community facilities is, therefore, only one component of community management of SAM and the capability to produce RUTF is just one step in that direction. 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 [4]. Largely plant-source-based diets with few animal source and fortified foods do not meet these requirements and need to be improved by processing, fortification, and adding animal source foods [5] *e.g.* milk, or other specific nutrients. Options include using specially formulated foods: fortified blended foods (FBFs), commercial infant cereals, ready-to-use foods *i.e.* pastes/compressed bars/biscuits, or complementary food supplements (CFS): micronutrient powders (MNP); powdered CFS containing (micro)nutrients, protein, amino acids and/or enzymes; or lipid-based nutrient supplements (LNS), 120-500 kcal/d, typically containing milk powder, high-quality vegetable oil, peanut-paste, sugar, (micro)nutrients. Most supplementary feeding program for moderately malnourished children supply FBFs, such as corn soy blend, with oil and sugar, which has shortcomings: too many anti-nutrients, no milk (important for growth), suboptimal micronutrient content, high bulk and viscosity [6].

1.2 Specially Formulated Ready to Use Foods

The World health organization standards for the treatment of malnutrition in children specify the use of two formulas during initial treatment F-75 and F-100. These formulas contain a mixture of powdered milk, sugar, and other ingredients designed to provide an easily absorbed mix of carbohydrates and essential micronutrients. RUTF is based on these formula providing 520-550 Kcal/100g. The nutritional composition of RUTF are as shown in **Table 2** [7].

1.3 Classification of Ready to Use Food

Broadly the the food product/Nutraceuticals are classified as dietary supplements & functional food & Beverages

There are 4 types of RUTF are as follows

1. RUSF (Ready-to-Use Supplementary Food)
2. RUCF (Ready-to-Use Complementary Food)
3. FBF (Fortified Blended Foods)
4. RUF-H (any of the above for HIV)
5. RUTF (Ready to use Therapeutic Food)

1.3.1 RUSF(Ready-to-Use Supplementary Food)

Ready to Use Supplemental Foods (RUSFs) are foods that are fortified with micronutrients as a remedy for malnutrition and can be consumed without cooking or the addition of water. They include Ready-to-use products such as pastes, compressed bars, and biscuits. RUSFs are formulated to supply all of the essential nutrients, both those required to maintain body function for normal growth. RUSF intended to provide nutrients consumed in sufficient quantities. A deficiency of one or several of the functional nutrients impairs physiological or immunological function without any effect on anthropometric indices. Supplement feeding with RUTF would result in better growth in Malawian children at risk of malnutrition (80% <weight-for-height <85%) than feeding with corn/soy-blend. It is prove that supplementary food can be used to treat MAM. Also RUSF with home based therapy improves the symptoms in sever acute malnutrition [8–10].

1. **Blanket supplementary feeding** Blanket supplementary feeding of all under-2's is likely more effective than targeted supplementary feeding of underweight under-5's. used (which have better micronutrient profile, and where possible include milk powder, sugar and oil). Alternative to be explored: staple for general population with additional CFS that provides 250-500 kcal for 6-23 or 6-35 month old children.
2. **Targeted supplementary feeding** Appropriate where blanket feeding is not necessary due to lower malnutrition prevalence [11].

1.3.2 RUCF(Ready-to-Use Complementary Food)

Complementary foods, whether based on customary family foods or commercially manufactured complementary foods tend to be bulkier than RUSFs. Although they may sometimes be fortified, they usually supply a smaller amount of fewer nutrients in a single meal. Many complementary foods need to be cooked [12].

Following are types for complementary food.

1. **Micronutrient Powder (MNP)** (Brand Names- Sprinkles, MixMe)It is effective for nutrition anemia and those with micro-nutrient deficiency. These contain micronutrient with zinc & protein.
2. **Powdered CFS** (Brand Names-Ying yang Bao, TopNutriTM) Italso of two parts one is consisting of protein and/or specific aminoacids and micronutrientswithout enzymes and another is same with enzymes (α -amylase, phylase) [13, 14].
3. **Lipid-based nutrient supplement (LNS)** it is marketed under the name of Nutributter, PlumpyDoz, Plumpy Nut, SupplPlumpy etc. Each product contain different component with different ingredients.

However, many of these products, designed optimize nutrient density and composition to yield improve outcomes. Have not yet been tested adequately for their impact on growth and other outcomes such as body composition and cognition, under typical settings.

1.3.3 RUF-H(any of the above for HIV)

In human immunodeficiency virus HIV-infected patients, malnutrition is associated with an increased risk of death and studies in industrialized countries have demonstrate that weight loss is a good predictor of both opportunistic

infection and death. WHO recommends that symptomatic HIV and AIDS patients to increase their daily energy intake by 50% from the requirements of normal active HIV negative adult of 2430 Kcal for male and 2170 kcal for female to keep proteins and vitamins and minerals intakes at normal daily requirement. Valid Nutrition has previously tested the efficacy of a chickpea-sesame RUTF among HIV-infected adults in Malawi [15].

1.3.4 FBF(Fortified Blended Foods)

Fortified blended foods, such as corn/soy blend (CSB) and wheat/soy blend (WCB) have been provided as one of the sole fortified food assistance commodities among many different populations, and for a wide range of purposes, for the past 30 years or more. They consist of 20-25% soy, 75-80% corn or wheat, and a micronutrient premix. But it is not a product well-adapted to meet the nutritional needs of young or moderately malnourished children because it contains a relatively large amount of anti-nutrients, it does not contain all the required nutrients [16].

2. RUTF(READY TO USE THERAPEUTIC FOOD)

RUTF is a subset of therapeutic foods, “are energy-dense, micronutrient-enriched which are soft or crushable or drinkable foods that can be directly given to patient without cooking”. The term ‘ready to use therapeutic food’ refers to several varieties of ready to eat foods, ranging from those prepared from locally available foods by village women in their own self-help groups for the malnourished children in their village, to those prepared according to specific formulas in factories to be shipped all over the world. The term now almost always refers to the latter, and specifically a peanut and milk- powder based spread with specified amounts of micronutrients, providing energy equivalent to WHO requirement *i.e.* 520-550 Kcal/100gm [17, 18]. Some basic ingredient of RUTF with their proportion are given below.

2.1 Types of RUTF Formulation

1. Commercially Produced RUTF

- (a) Solid form
 - i. Powders (sprinkles)
 - ii. Blends
 - iii. Biscuits
 - iv. Candy Bars
- (b) Semisolid forms
 - i. Paste
 - ii. Creams
- (c) Drinkable Therapeutic food

2. Locally produced RUTF

Shelf life is not a necessary condition for these locally produced ready to eat foods as they are prepared in quantities needed by local women’s groups under the supervision of the respective hospital or Non Government Organisation.

Table 1. Classification of Malnutrition on Basis of Z-score Value

Classification	Z-score values
Adequate	$-2 < Z\text{-score} < + 2$
Moderately malnourished	$-3 < Z\text{-score} < - 2$
Severely malnourished	$Z\text{-score} < - 3$

Table 2. Nutrition Composition in RUTF

Nutrition composition	% Energy & Conc in mg
Moisture content	2.5% maximum
Energy	520-550 Kcal/100g
Proteins	10 to 12% total energy
Lipids	45 to 60% total energy
Sodium	290 mg/100g maximum
Potassium	1100 to 1400 mg/100g
Calcium	300 to 600 mg/100g
Phosphorus (excluding phytate)	300 to 600 mg/100g
Magnesium	80 to 140 mg/100g
Iron	10 to 14 mg/100g
Zinc	11 to 14 mg/100g
Copper	1.4 to 1.8 mg/100g
Selenium	20 to 40 g
Iodine	70 to 140 g/100g
Vitamin A	0.8 to 1.1 mg/100g
Vitamin D	15 to 20 g/100g
Vitamin E	20 mg/100g minimum
Vitamin K	15 to 30 g/100g
Vitamin B1	0.5 mg/100g minimum
Vitamin B2	1.6 mg/100g minimum
Vitamin C	50 mg/100g minimum
Vitamin B6	0.6 mg/100g minimum
Vitamin B12	1.6 g/100g minimum
Folic acid	200 g/100g minimum
Niacin	5 mg/100g minimum
Pantothenic acid	3 mg/100g minimum
Biotin	60 g/100g minimum
n-6 fatty acids	3% to 10% of total energy
n-3 fatty acids	0.3 to 2.5% of total energy

Table 3. Common Ingredients in RUTF

Ingredient	% weight
Full fat milk	30
Sugar	28
Vegetable oil	15
Peanut butter	25
Mineral Vitamin Mix	1.6

Table 4. Milk Nutrients in Different Species

Nutrient	Cow	Buffalo	Human
Water	88.0	84.0	87.5
Energy, kcal	61.0	97.0	70.0
Protein, g	3.2	3.7	1.0
Fat, g	3.4	6.9	4.4
Lactose, g	4.7	5.2	6.9
Minerals, g	0.72	0.79	0.20

Table 5. Several Vegetable Oils

Oils	Saturated fat	Monounsaturated fat	Polyunsaturated fat
Sunflower oil	11g	20g (84g in high oleic variety)	69g (4g in high oleic variety)
Soybean oil	16g	23g	58g
Olive oil	14g	73g	11g
Corn oil	15g	30g	55g
Peanut oil	17g	46g	32g
Butter	51g (63%)	21g (26%)	3g (4%)

Table 6. Sesame' RUTF 1

Roasted rice flour	20.0 %
Soyamin	90%
Roasted sesame seeds paste	29.0 %
Sunflower oil	19.4 %
Icing sugar	22.0%
Premix	1.6%
Total	100%

Table 7. Barley - Sesame' RUTF 1

Roasted pearl barley flour	15.0 %
Soyamin 90	9%
Roasted sesame seeds paste	29.0 %
Sunflower oil	24.0 %
Icing sugar	23.4%
Premix	1.6%
Total	100%

Table 8. Maize - Sesame' RUTF 1

Roasted maize flour 33.4 %	33.4.0 %
Roasted sesame seeds paste	27.0%
Roasted chick peas flour	24.0 %
Sunflower oil	24.0 %
Icing sugar	23.4%
Premix	1.6%
Total	100%

Table 9. Ingredient for Ready-to-drink Peanut-based Therapeutic Food

Ingredients	Therapeutic food (gm)		
	A	B	C
Peanuts	50	50	40
Beans	25.5	25	35
Sesame		10	
Cowpeas	10		11
grain amaranth	7	7	7
Sugar	7.5	7.5	7

Table 10. Supplier with Product Name

Sr. No.	Suppliers	Product Name
1	Compact AS, Norway	EeZeePaste TM
2	Compact Pvt. Ltd, India	EeZeePaste TM
3	Diva Nutritional Products (Pty) Ltd, RSA	Generic name
4	Edesia, USA	Plumpy Nut
5	Hilina, Ethiopia	Plumpy Nut®
6	InnoFaso, Burkina Faso	Plumpy Nut®
7	Insta Products Ltd, Kenya	Generic name
8	Mana Nutritive Aid Products Inc., USA	Generic name
9	MFK, Haiti	Plumpy Nut®
10	Nutriset SAS, France Hilina, Ethiopia	Plumpy Nut
11	NutriVita Foods Pvt. Ltd, India	Plumpy Nut
12	Power Foods, Tanzania	Plumpy Nut
13	Project Peanut Butter, Malawi	Plumpy Nut
14	Project Peanut Butter, Sierra Leone	Plumpy Nut
15	Samil Industry, Sudan	Nutty duz
16	SociétéJB, Madagascar	Plumpy Nut
17	Sociétéde Transformation Alimentaire, Niger	Plumpy Nut®
18	Tabatchnick Fine Foods Inc., USA	Nutty Butta
19	Valid Nutrition, Malawi	Plumpy Nut®
20	Vitaset SA, Dominican Republic	Plumpy Nut

2.2 Ingredients

Common ingredient with their composition are as shown in [Table 3](#)[19] all ingredient are discussed below

2.2.1 Milk

Milk is important constituent of the RUTF which is contain 30% of RUTF. According to stability of milk there is need to be use of powder milk in RUTF formulation. Milk is itself a good dietary food because it contain lots of nutrition composition, the milk composition of different species (amount per 100 g) [20] as shown in [Table 4](#).

Table 11. Cost Analysis

Suppliers	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Compact AS, Norway											2333	2386	
Compact Pvt. Ltd, India										2308	2309	2283	2939
Diva Nutritional Products (Pty) Ltd, RSA									2536	2500	2388	2385	2290
Edesia, USA											3108	3108	3108
Hilina, Ethiopia												3444	
Insta Products Ltd, Kenya									3270	3282	3487	3383	
Mana Nutritive Aid Products Inc., USA											3119	3119	3368
Nutriset SAS, France Hilina, Ethiopia	2574	2574	2528	2546	2546	2546	2546	2413	2318	2218	2281	2233	2340
NutriVita Foods Pvt. Ltd, India											2927	2927	2927
Power Foods, Tanzania													2431
Tabatchink fine foods inc, USA									3712	3509	3350	3315	3168
Vitaset, S.A. Dominican Republican								3875	3158	3076	2942	2942	3013
Samil Industry, Sudan												3868	3744
SociétéJB, Madagascar											2281	2281	2299

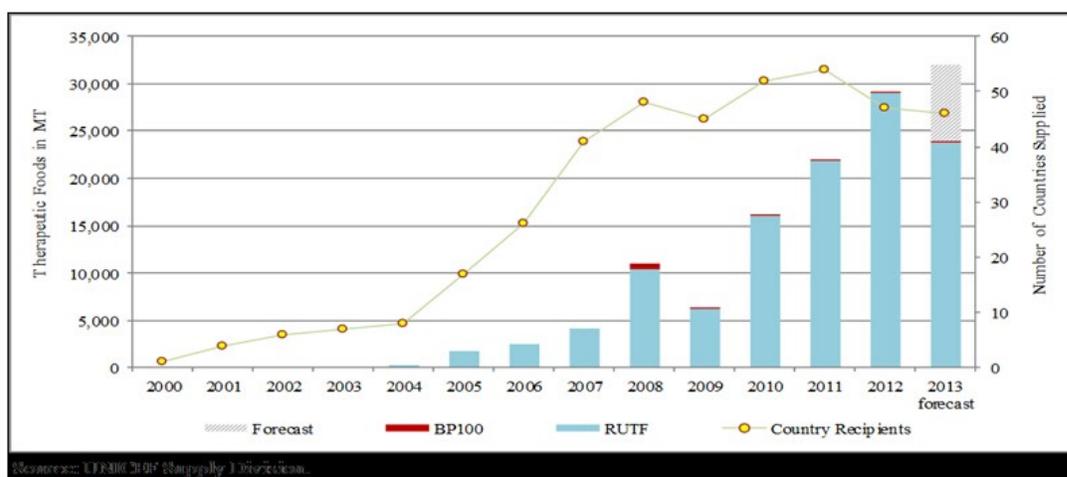


Figure 1. Production Data Analysis

2.2.2 Sugar

It is major source of carbohydrate which provides energy as well as taste to the formulation. To facilitate the incorporation of the sugar particles in the fatty part of the RUTF the sucrose particles dimensions should be carefully controlled and stay below 200 μm . In RUTF sugar can be replaced by the pure jaggery, or icing sugar etc.

2.2.3 Vegetable oil

Different vegetable oil to be used in RUTF formulation is given with their fatty acid composition per 100g in following table. Considering the balance of the essential fatty acids, soy oils seem to be the better ones in the RUTF formulations, some oils with their content are shown in **Table 5**.

2.2.4 Peanuts

It is base component for RUTF formulation which roasted and then size is reduced less than 200 μm . The storage of locally produced peanuts used in the RUTF formulation in non safe conditions can increase the contamination risk connected to the presence of aflatoxins.

2.2.5 Mineral Vitamin Mix-

Minerals and vitamins are added to the formulations as a complex of minerals and vitamins (CMV). The mixture of powdered vitamins and salts is the same as that mentioned in **Table 1**. The CMV mixture it is usually the only imported main ingredient in the case of local production of the RUTF [21].

2.3 Some Characteristics Features of RUTF

There are certain ideal characteristics which a RUTF should possess as follows,

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 & aflotoxins.

3. ALTERNATIVE FORMULATIONS FOR RUTF-

According to data reported by Valid International and by the Clinton Foundation for Malawi the 68% of the total cost for the RUTF is due to the cost of the ingredient and, among these, the powdered milk contributes itself for the 42%. Powdered milk according to these data accounts consequently about the 29% of the total RUTF cost. A breakthrough in the RUTF production to cut the cost down could be the replacement of the powdered milk in the RUTF recipe as suggested by UNICEF. Steve Collins et al led to a list of 13 product had reasonable theoretical properties. Following numerous products development trials, the list was reduce to three potential alternatives. The foods were prepared from roasted or processed ingredients with total exclusion of water. They had low dietary bulk, low potential for bacterial contamination and were ready to eat without cooking. Similarly, the commodities chosen had the most appropriate energy density and high biological value of protein [22]. Alternative RUTF formulations have been proposed, and are based on four main ingredients: a cereal as the main ingredient, 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 had an optimal physical characteristic of being soft in consistency, easy to swallow and suitable for infant feeding Also another sesame based formulation containing following ingredient [23]:

Rice - Sesame' RUTF 1

Ingredients: Roasted rice flour, roasted sesame seeds paste, Soyamin 90, sunflower oil, icing sugar, vitamin and mineral premix (CMV therapeutic, Nutriset). **Table 6**

Barley - Sesame' RUTF 2

Ingredients: Roasted pearl barley flour, roasted sesame seeds paste, Soyamin 90, sunflower oil, icingsugar, vitamin and mineral premix (CMV therapeutic, Nutriset). **Table 7**

Maize - Sesame' RUTF 3

Ingredients: Roasted sesame seeds paste, roasted maize flour, roasted chickpeas flour, sunflower oil, icing sugar, vitamin and mineral premix (CMV therapeutic, Nutriset). **Table 8** In accordance to increase in cost of RUTF due to milk powder which is very expensive so Nakimbugwe et al study & formulated a ready-to-drink peanut-based therapeutic food that matched the nutrient composition of F100 using plant sources with peanuts, beans, sesame, cowpeas and grain amaranth as ingredients [24]. See **Table 9**.

4. SEVERAL CLINICAL TRIALS CONDUCTED ON FOR RUTF TESTING

A number of randomized clinical trials have evaluated the efficacy of RUTF in the management of children suffering from SAM. In an Indian study, RUTF was compared with a cereal and legume based porridge (khichri). Thirty one children aged 6 to 36 months and from urban low to middle socioeconomic class neighborhoods with malnutrition (weight for height Z scores -2 to -3) without infection or edema were recruited. The children were given unlimited offerings of weighed amounts of either RUTF or khichri and water on demand for 2 days. It was found that 58% and 77% children accepted RUTF and khichri eagerly ($p=0.35$). The median energy intake over the 2 days was 305 kcal from RUTF and 242 kcal from khichri ($p=0.02$). The authors concluded that both the foods had good acceptability, but RUTF, being more energy dense, provided higher energy intake [25].

Isanaka, et al evaluated the efficacy of RUTF in the prevention of moderate to severe malnutrition. 12 villages in Nigeria were selected for randomized trials of RUTF supplementation for 3 months. All children aged from 6-60 months from these villages with weight for height more than 80% were . The difference in weight for height Z score between the RUTF and non-intervention groups at the beginning and after 8 months of follow-up were -0.10Z and

0.12Z respectively. The adjusted effect of intervention was thus 0.22. RUTF supplementation also resulted in 36% (95% CI, 17% to 50%, $p < 0.001$) reduction in the incidence of wasting and 58% (95% CI, 43% to 68%, $p < 0.001$) reduction in the incidence of severe wasting. It was concluded that short term RUTF supplementation decrease the fall in weight for height Z score and the incidence of wasting over an 8 months follow-up [26].

In a Malawian study, 1178 children with moderate or severe wasting, kwashiorkor or both were randomly assigned to receive either home based RUTF or standard therapy and their recovery rates evaluated. Children who received home-based RUTF were more likely to achieve weight for height Z score > -2 (79% vs 46%, $p < 0.001$), had higher rates of weight gain (3.5 vs 2.0 g/kg/day; difference: 1.5; 95% CI: 1.0, 2.0 g/kg/day) and had lower prevalence of fever, cough and diarrhea. Hence, home-based RUTF was found to have better outcome in the treatment of malnutrition. In another Malawian study, 11 282 malnourished HIV negative children were assigned to receive either RUTF in sufficient quantity to meet their requirement for full catch up growth or micronutrient fortified RUTF in amounts that will provide 33% of their daily nutritional requirement or maize-soy flour with micronutrients in quantity sufficient for full catch-up group. It was seen that the RUTF group was more likely to reach weight for height Z score > 0 as compared to the other two groups (95% vs 78%, RR 1.2, 95% CI 1.1 to 1.3). The average weight gain was also higher in The RUTF group (5.2g/kg/day vs 3.1g/kg/day). Hence, home-based RUTF therapy was found to be more successful than the other two modalities [27, 28].

In India Vinodwasnik et al was done controlled randomized clinical trials in rural area of Maharashtra (Amravati) to evaluate effect of locally made ready-to-use therapeutic food –mushpro health drink powder (MHDP) for treatment of malnutrition on children aged 6 to 72 months and comes to conclusion that Community based treatment by locally made nutritious food MHDP showed significant weight gain and height gain in Experimental group and proved to be more effective in management of SAM and MAM [29].

The RUTF is consist of the different common ingredients like milk as protein source, sugar as carbohydrate source, vitamins and mineral mixture, vegetable oil as fat source, peanuts. Available dosage forms for RUTF are blends, Powder, Semisolid Paste, Biscuits, Liquid drinks. Among these the semisolid paste which are based on the peanuts are widely used some examples of RUTF product with suppliers and brand names are given in **Table 2** [30].

5. PROBLEMS ASSOCIATED WITH RUTF

1. Ready to Use Therapeutic Food (RUTF) is successfully used to treat severe acute malnutrition. But it is now increasingly also being used for the prevention of young child malnutrition.
2. The commercially produced RUTF, bought and distributed by UN agencies and non-governmental aid organisations, is a totally unaffordable option for most people who live in poverty.
3. The promotion of RUTF may undermine breastfeeding: both exclusive breastfeeding, up to 6 months of age, and sustained breastfeeding, for children of 6-24+ months of age,
4. The promotion of RUTF is now medicalising and commercialising the prevention of malnutrition, which is better achieved by local measures to improve food intakes, health services and child care.
5. It is unrealistic and even irresponsible, to suggest that RUTFs could be provided worldwide to the very many millions of children identified as having mild malnutrition or chronic hunger.
6. There are as yet no universally agreed upon guidelines for the use of RUTF [31].

6. CURRENT OUTLOOK ON RUTF DEMAND

RUTF procured through UNICEF comes in two product forms:

- RUTF Therapeutic Spread: An energy dense, micronutrient paste based on a mixture of peanuts, sugar and milk powder (suitable for children 6 – 24 months), *e.g.*, Citadel Spread.
- RUTF BP100: An energy dense, nutrient-fortified wheat and oat bar (suitable for older children)*e.g.*, Plumpy Nuts.

Demand for RUTF therapeutic spreads has been extensively increases yearly. UNICEF started procuring RUTF in 2000. The growing number of pilot programmes and the subsequent endorsement of a community-based management approach to acute malnutrition in 2007 by WHO, WFP, UNICEF and the United Nations System Standing Committee on Nutrition (UNSSCN), resulted in the demand for RUTF through UNICEF increasing to nearly 29,000 MT (**Figure 1**). The increased quantity represents the treatment of more than 2 million children in 47 countries and has been driven by recent emergencies and greater programmatic acceptance.⁶ Nevertheless, current supply through UNICEF only covers 10% of the estimated global caseload of SAM. **Figure 1** shows increase in procurement of RUTF yearly in million tones.

7. COST ANALYSIS DATA REGARDING RUTF

The table showing the pricing data of some companies from year 2001 to 2013 in Indian currency (rupees).Includes only orders issued by Supply Division to listed suppliers.Data shows the weighted average prices for 1 carton of RUTF containing 150 sachets of 92g each [32].

8. RUTF IN INDIA

8.1 Opportunities for India for RUTF production

Ingredients required for the manufacture of RUTF are readily available in India.

- India is the number one producer of milk in the world and over 1.6 lakh tonnes of milk powder are produced in India every year.
- India is the largest exporter of shelled groundnuts in the world.
- Bharat Immunologicals and Biologicals Corporation Limited (BIBCOL), a public sector company that manufactures vaccines and zinc tablets has developed a composite mineral and vitamin (CMV) formulation.
- Also the alternative which are required to formulate RUTF are also commercially available at low cost [33].

If RUTF produced& distribute in India it will ultimately reduces the cost of RUTF.

As per information received from the Ministry of Women & Child Development, 'Ready To Use Therapeutic Food' (RUTF), costing approximately Rs.11.5 crores, was imported by UNICEF India into the country between August 2008 and January 2009. RUTF was supplied and used in Madhya Pradesh and Bihar to treat children with severe

acute malnutrition. RUTF was used in Bihar and Madhya Pradesh without any request or approval of Government of India. Use of RUTF is not a policy of Government of India. The whole issue was examined in consultation with the Ministry of External Affairs. UNICEF has been directed to discontinue the use of RUTF and ship the stocks out of the country. UNICEF has further been asked not to act on any requests received directly by them, from State Governments. Disbursal of medicines and other health and family welfare related supplies be made under the supervision of the State Health and Family Welfare authorities with the knowledge/ concurrence of Ministry of Health & Family Welfare.

8.2 Future Perspective for RUTF

- Locally produced energy rich food or manufactured by local people and groups using local food ingredients should be used for community management of severe forms of malnutrition.
- Strategies to manage all forms of malnutrition, including severe acute malnutrition, should be food-based, not single supplement product-based.
- Reduction in the prevalence of severe malnutrition, particularly in children, over a specified period of time, should be the first indicator of the success of strategies to manage malnutrition.
- Reduction in RUTF cost using different alternative sources of nutrition or by reducing process parameter.

9. CONFLICT OF INTEREST

The authors declare that they do not have any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work.

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