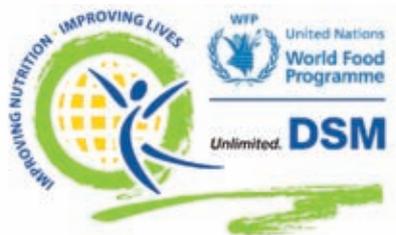


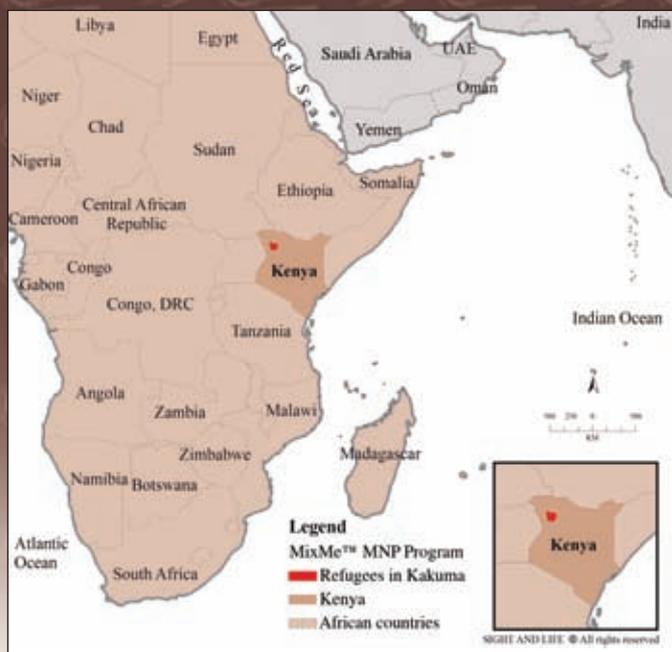
Micronutrient Powder (MixMe™) Use in Kakuma Refugee Camp in Kenya (AFRICA)



“ People living in refugee camps largely rely on food assistance, which typically consists of staples (whole grains or flour), pulses, fortified blended food, vegetable oil and iodized salt. In addition, as a result of limited opportunities for earning an income or growing food, they have few options to complement their diet. Consequently the diet of refugees makes them vulnerable to vitamin and mineral (micronutrient) deficiencies.”

World Food Programme (WFP)

Map created by Salahuddin Ahmed



Capital:	Nairobi
Population:	37,953,840
Population Density:	59 per km ²
Unemployment Rate:	40%
Life Expectancy at Birth:	56.64 years (total population)
GDP per Capita (PPP):	US\$1,800
Infant Mortality Rate:	80 deaths/1000 live births
Literacy Rate:	85.5%

Increasingly, the high levels of anemia and micronutrient deficiencies found in refugee camps has led to the recognition that food rations used in these camps have not been sufficient to meet the nutritional needs of those receiving the rations, especially the young children and pregnant and lactating women, who are the most vulnerable to deficiencies. This has led to an initiative by the World Food Programme (WFP) in partnership with DSM and the United Nations High Commissioner For Refugees (UNHCR) to look at ways to improve the quality of the diet including the addition of micronutrient powders (MNP) to the food basket being used in refugee camps.

The role of Micronutrient Powders

MixMe™, an MNP produced and donated by DSM, has been distributed in the refugee camps as a joint initiative by the WFP-DSM partnership known as 'Improving Nutrition – Improving Lives', and the UNHCR. Although there are several options for increasing the micronutrient intake in refugee camps, such as supplementation or the use of fortified special foods, a single 1 g sachet of MNP added to an individual's meal just before eating (home fortification), offers many advantages:

- MNPs are a food-based, rather than a medicinal, approach, which is more in line with the long-term sustainable goal of a population-wide preventative approach.
- Although the general fortification of food is widely accepted as being an excellent way of adding micronutrients to the diet, it often cannot meet the needs of young children who ingest smaller amounts of foods and have higher micronutrient needs to support optimal growth and development.
- MNP is a cost-effective intervention with 'cost per disability-adjusted life year (DALY)' saved' being an estimated US\$12 and 'cost per death averted' being US\$406.²
- The 1 g sachets of MNP have been designed to be durable, with a minimum 12-month shelf-life in tropical conditions, and so offer the best possible protection against the often harsh climatic conditions in many countries.
- Each sachet contains a daily dose of micronutrients and they are easily packed 30 to a packet. In this way each targeted beneficiary can receive a single packet at the first distribution cycle of each month, ensuring a month's supply.
- As the daily dose of micronutrients contained in a sachet is well below the upper limit of intake for each individual micronutrient the risk of over-dosing is low.
- The relative ease of use of MNP and few side-effects compared with other interventions such as iron drops and tablets have been shown to result in improved acceptability and compliance.



MNP packaging

THE OPTIONS

Supplementation refers to periodic administration of medicinal preparations of nutrients such as capsules, tablets or drops. Nutritional supplementation is usually restricted to vulnerable groups who cannot meet their nutrient needs through food, such as women of childbearing age, infants and young children, elderly people, low socioeconomic groups, the chronically ill (TB or HIV/AIDS) and populations experiencing other emergency situations.

Food fortification is the practice of deliberately increasing the amount of an essential micronutrient, i.e. vitamins and minerals (including trace elements) in a food, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health. Traditionally foods that are fortified are the staple foods and condiments (such as wheat or maize flour, vegetable oil, soy or fish sauce, salt or sugar) commonly eaten by the most vulnerable in order to ensure the widest coverage.

Home fortification refers to the strategy where vitamins and minerals usually used for food fortification are added to the commonly eaten, prepared food just before consumption. Through home fortification the micronutrients can be well-targeted and specifically dosed (one dose per individual), and as they are added to the plate or bowl of food just before eating, they are not subject to processing and preparation that could reduce their content or bioavailability. The concept of home fortification has been proven to be efficacious for reducing deficiencies among young children under controlled circumstances. MNP is one form of a home fortification product and increasingly being used as an intervention.



Refugees living in Kakuma are mainly housed in mud-brick huts with corrugated iron roofs. The camp's terrain is dry, flat and barren and dust storms are a daily occurrence. Water is scarce and rain is occasional and frequently leads to flooding. WFP has been supporting the camp since 1991 by providing families with basic food items.

Assessing the impact of Micronutrient Powders in improving lives

The International Rescue Committee (IRC) and UNHCR conducted a nutrition survey at Kakuma refugee camp in 2007 and one of the major findings indicated that 86.4% of children under 5 years of age and 40.7% of the women were anemic. The high prevalence of anemia made intervention imperative and in a malaria endemic area, the MixMe™ formulation designed for these conditions was selected for home fortification use (see table on page 4).

The current program provides 50,000 individuals with a once-a-day MNP sachet for a period of 1 year – some 18 million sachets of MNP. An extensive communication program that includes a film, pamphlets and plays is running concurrently to promote proper use of the MNP, increase awareness of the program and aid compliance.

A comprehensive study designed to assess both the prevalence of anemia and iron deficiency anemia is part of the overall program. Program beneficiaries selected to be part of the study were interviewed and assessed prior to the start of the program and will be assessed again after 6 and 12 months in order to determine the effectiveness of the MNP in a program setting, to monitor the acceptability of the MNP and assess adherence to a home fortification program. The research is being jointly conducted by WFP, UNHCR, IRC, Kenya Medical Research Institute (KEMRI) and Johns Hopkins University, Baltimore.

An initial trial with MNP showed high acceptability by mothers who acknowledged improvement in the health of their children, saying that they were looking healthy, playing more and had an increased appetite.



The concept of home fortification has been tested in several studies that have mostly been in controlled settings and have been shown to be effective in reducing anemia prevalence. However home fortification is still new to most populations and the strategy had not yet been used on a large scale in combination with general food distribution. The Kakuma program in Kenya will be one of the first of four large-scale MNP implementation programs to be piloted by the WFP in partnership with DSM and the UNHCR where refugee populations are involved. Three other pilots have been implemented in Bangladesh (one as part of the cyclone Sidr emergency response and the other amongst the Rohingya refugees) and Nepal (Bhutanese refugees in Damak). The fifth large-scale MNP implementation program will be launched among children under the age of five years in Nepal in 2009.

Refugees in Kenya

Eastern and Central Africa has been burdened with civil strife and recurrent social upheaval. As a result, refugees from many countries, including Somalia (47%), Sudan (38%) and Ethiopia (10%) as well as the Congo, Uganda, Rwanda, Eritrea, Namibia and Zimbabwe, have sought safety in Kenyan refugee camps. Kakuma refugee camp is situated in an extremely remote semi-arid area in the north of Kenya and is one of the biggest refugee camps (approximately 20 x 4 kilometers) in the world. Some 52,000 refugees as of January 2009 live in the Kakuma refugee camp and rely on WFP food assistance.

Micronutrients included in Kakuma Refugee Camp MNP

Nutrient	Unit	Joint Statement UNICEF/WHO/WFP <5 years No fortified food available Non malaria area	Amount per 1g sachet	Percentage contribution to Joint Statement UNICEF / WHO / WFP <5years
Vitamin A	µg RE	400	100 ¹	25
Vitamin D	µg	5	5	100
Vitamin E	mg	5	5	100
Vitamin K	µg	-	30 ²	200
Thiamine	mg	0.5	0.5	100
Riboflavin	mg	0.5	0.5	100
Pyridoxine	mg	0.5	0.5	100
Folic Acid	µg	150	90	60
Niacin	mg	6	6	100
Vitamin B12	µg	0.9	0.9	100
Vitamin C	mg	30	60 ³	200
Zinc	mg	4.1	2.5 ⁴	60
Iron	mg	10	2.5 ⁵	40
Selenium	µg	17	17	100
Copper	mg	0.56	0.34 ⁶	100
Iodine	µg	90	30 ¹	33

1 Reduced because fortified foods provided by WFP already contribute a considerable amount.
 2 Vitamin K added as intake is usually low where vegetable consumption is low.
 3 Increased to enhance iron absorption.
 4 Zinc reduced in order to not be higher than the (reduced) iron content.
 5 Reduced due to intervention being in a malaria endemic area (10% bioavailability).
 6 Copper reduced to US RDA as upper intake level is 1 mg and the foods to which the MNP is added generally contain copper.

The initial assessment (baseline survey) took place in January 2009 and the provision of the MNP began in February 2009. The 6 and 12 month surveys among the same individuals (under-fives and non-pregnant women) will be conducted in August 2009 and February 2010. Meanwhile, the 6-monthly cross-sectional health and nutrition surveys undertaken by IRC/UNHCR, will continue, with the last one having been in October 2008. The final results are expected in the second quarter of 2010.

Activities to reduce malaria transmission in the Kakuma refugee camp

In an effort to reduce the incidence of malaria and minimize the risks involved in untargeted iron supplementation / fortification, UNHCR and its implementing partners in Kenya are providing artemisinin-based combination therapy (ART) for the treatment of malaria. As preventative measures, long-lasting insecticide-treated bednets (LLINs), and culturally appropriate information, education, and communication (IEC) campaigns and materials are being provided to the refugees.

More information

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Rationale for MNP with low iron content

According to the World Health Organisation (WHO), untargeted iron supplementation of young children in malaria endemic areas could increase the risk of malaria-related morbidity and mortality among young, iron-sufficient children (http://www.who.int/entity/child_adolescent_health/documents/pdfs/who_statement_iron.pdf). For this reason, untargeted home fortification of foods with MNP containing low levels of highly bioavailable iron, together with iron absorption enhancers such as NaEDTA and ascorbic acid, is probably safer than using powders containing higher iron doses, although this needs verification. In Africa, where malaria is prevalent, approximately half of the anemia is caused by iron deficiency. Fortified food commodities, such as corn / wheat soy blend, which are often the main dietary source of iron for refugees, are recognized to be low in bioavailable iron due to their high phytate content. Thus, an additional amount of low dose iron of 2.5 mg/d from NaFeEDTA in MNP, in combination with iron derived from regular diet and fortified food commodities, will help to fulfil the iron needs of the most vulnerable population groups including young children and women (see the table below). In addition, the extra iron from the MNP will help to re-fill the iron pools of those individuals deficient in iron.

Child age (years)	Daily absorbed iron requirement (mg) ^{1,2}		Estimated daily absorbed iron from food sources (mg) ³	Estimated daily absorbed iron from MNP (mg) ^{7,8}			Total daily absorbed iron (mg)
	Median ³	95th percentile ⁴		5% ⁶	10% ⁹	15% ¹⁰	
1 – 3	0.46	0.58	0.25	0.25	0.37	0.5 – 0.62	
4 – 6	0.50	0.63	0.36	0.25	0.37	0.61 – 0.73	

1 Vitamin and Mineral Requirements in Human Nutrition 2nd Edition, WHO/FAO 2004.

2 Total daily requirement for absorbed iron to support growth and to balance the basal iron losses.

3 Values represent the median of the total daily requirement for absorbed iron.

4 Values represent the 95th percentile of the total daily requirement for absorbed iron.

5 Based on a daily corn soy blend intake of 40 g (1 – 3 y) or 60 g (4 – 6 y) with iron content (from fortification and from the ingredients themselves) of 12 mg/100 g. Note that absorption of iron from other foods consumed is not included.

6 Assuming a 5% iron absorption rate.

7 MNP containing 2.5 mg iron from NaFeEDTA.

8 Not including the absorption enhancing effect of ascorbic acid and NaEDTA on intrinsic iron.

9 Assuming 10% of the iron from MNP is absorbed.

10 Assuming 15% of the iron from MNP is absorbed.

The low-iron containing MNP may help to significantly reduce the prevalence of iron-deficiency anemia in refugees in Kenya. Moreover due to the inclusion of other micronutrients important for the formation of red blood cells, the use of MNP is considered to be a more comprehensive and innovative approach compared to single-nutrient supplementation/fortification in the global fight against nutritional anemia and micronutrient malnutrition.

1 DALY – Disability-adjusted life year is a measure of overall disease burden. Originally developed by the World Health Organisation, is becoming increasingly common in the field of public health and health impact assessment. It is designed to quantify the impact of premature death and disability on a population by combining them into a single, comparable measure.

2 Zlotkin SH, Tondour M. Successful approaches: Sprinkles. In Kraemer K, Zimmermann MB. Nutritional Anemia. SIGHT AND LIFE Press; 2007.