



# Fortifying food in the field to boost nutrition: case studies from Afghanistan, Angola and Zambia

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**World Food  
Programme**

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## EXECUTIVE SUMMARY

Deficiencies in micronutrients such as iron, vitamin A and iodine affect billions of people worldwide, causing death, disease and disability.

The World Food Programme has long been recognised for its ability to deliver food to some of the most remote locations, under the toughest conditions: refugees in border camps, populations cut off by conflict, extremely poor and marginalised people like ethnic minorities, orphans and widows.

Relatively little, however, is known about its efforts to ensure that the food it delivers not only provides enough calories for survival but also provides the vitamins and minerals needed for healthy growth and development. Much of the food delivered by WFP is fortified with iron, vitamin A and other micronutrients before being shipped. But there are several reasons to mill and fortify food as close to the beneficiaries as possible. For instance, milling and fortifying food locally helps to overcome the problems of the short shelf-life of whole fortified maize meal. It also enhances the nutritional value of locally

procured cereals. And it can foster demand for fortified foods among local consumers beyond WFP beneficiaries, thus nurturing an industry with potentially significant benefits for the health of entire communities.

This Occasional Paper outlines three approaches by WFP to fortifying food in Afghanistan, Angola and Zambia. It examines the challenges faced and the outcomes achieved in an effort to share this knowledge with others dedicated to improving the nutritional status of poor and food-insecure people.

In Afghanistan, attempts to mill and fortify wheat flour using small-scale *chakki* mills were successful but much larger-scale efforts would be needed to promote demand and reach the level of consumption required to address serious deficiencies in iron across the country.

In Angola, maize has been fortified to combat the persistent occurrence of pellagra, a micronutrient deficiency disease found among people whose diets are dominated by maize. By providing fortification equipment to a commercial mill at the port of Lobito and using a vitamin and

mineral pre-mix provided by UNICEF, this project has overcome many of the difficulties common in countries emerging from conflict to provide monthly fortified maize rations to 115,000 beneficiaries.

In Zambia, iron deficiency was a serious problem among camp-restricted refugees. WFP and its partners imported, installed and trained workers in the use of two Containerized Milling and Fortification Units (MFUs), halved iron-deficiency anaemia and reduced vitamin A deficiency among camp residents. In addition, WFP dramatically reduced waiting times for refugees who used to have their whole grain maize rations milled at small local facilities with insufficient milling capacity.

The context and scale of each of the three case-studies described in this paper was different,

but the lessons learned are comparable. All projects were successful in their own right, but also required a considerable amount of staff time and supervision as well as external technical expertise, limiting the potential for scaling up within the WFP operational context. In order to expand and sustain the provision of fortified cereal flour to WFP beneficiaries and beyond, getting the private milling sector as well as governments on board would be crucial. Where this is not possible, such as in very isolated, difficult to reach locations, strong, specialized partners are a prerequisite, but these are few in number. Alternatively, in such contexts or in situations where the need is urgent and cannot be met through local flour fortification in the short term, other approaches to improve the diet, such as the use of multimicronutrient formulations, packed for individual or household use, may be more appropriate.

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## INTRODUCTION

According to the World Health Organization (WHO), deficiencies in iron, vitamin A and zinc rank among the top ten leading causes of death through disease in developing countries. Most people affected by micronutrient deficiencies do not show overt clinical symptoms nor are they themselves necessarily aware of the deficiency, a phenomenon called ‘hidden hunger’. Yet hidden hunger makes people susceptible to infectious diseases, impairs their physical and mental development, reduces their labour productivity and increases the risk of premature death.

There is a close relationship between malnutrition,

which is often linked to lack of food, and specific micronutrient deficiency diseases that are associated with consumption of foods poor in micronutrients. Iron deficiency, for example, is one of the most widely prevalent micronutrient deficiencies in the world, affecting at least half of all pregnant women and young children in developing countries. A lack of vitamin A is not only the leading cause of child blindness across developing countries, it also affects children’s immune systems and is directly responsible for more than ten million deaths each year. The economic impact of vitamin and mineral deficiencies often exceeds two percent of gross

domestic product per year. Since WFP's beneficiaries are known to have limited access to a varied diet, a large proportion of them also suffer from micronutrient deficiencies, which is compounded even further when they are fully dependent on rations for survival, such as camp-restricted refugees.

Fortification of food is considered one of the most cost-effective approaches to addressing widespread deficiencies. According to the World Bank "... probably no other technology available today offers as large an opportunity to improve lives and accelerate development at such low cost and in such a short time". WFP addresses micronutrient deficiencies through:

- (i) careful attention to micronutrient needs in ration planning;
- (ii) programming donor-supplied or internationally procured fortified foods;

- (iii) promotion and use of locally processed fortified foods; and
- (iv) increasing advocacy for fortification at national and international policy-making levels.

Working with partners such as UNICEF, UNHCR and the Micronutrient Initiative (MI), WFP advocates placing micronutrient deficiency diseases higher on international and national political agendas. WFP is already the world's leading purchaser of fortified blended foods, following guidelines which prescribe the type and quantity of vitamins and minerals each commodity should contain. It also promotes local capacity to produce fortified blended food as well as milling and fortification of cereals in some of the world's poorest countries – the subject of this Occasional Paper.

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## AFGHANISTAN

Years of conflict in Afghanistan have had a devastating effect on the health of the national population. A number of classic micronutrient deficiency diseases are prevalent, notably iron deficiency anaemia (IDA), vitamin A deficiency, including night blindness, scurvy (vitamin C deficiency), beriberi (vitamin B1 deficiency), pellagra (niacin deficiency), neural tube defects and folic acid deficiency, as well as pregnancy complications and high rates of maternal and infant mortality.

The National Micronutrient Survey carried out by the Ministry of Public Health (MoPH) and

UNICEF in 2004 found that 37 percent of Afghanistan's pre-school children, 25 percent of women of childbearing age and 7 percent of men were anaemic, while 38 percent of children aged 6-59 months, 48 percent of non-pregnant women and 18 percent of adult men were iodine deficient.

Bread is a staple food in Afghanistan and almost half of the caloric intake of Afghans is estimated to come from bread. In the most vulnerable areas, many of the poorest Afghans subsist on just tea and bread.

Despite the limited information on the incidence

and prevalence of micronutrient diseases in Afghanistan, it is clear that addressing micronutrient deficiencies through flour fortification should be a priority, especially as the costs involved are low and the impact on the health of Afghans would be enormous.

## Background

WFP has distributed flour – milled and fortified elsewhere – through its food assistance project for Internally Displaced People (IDPs) in Afghanistan for many years.

Aware that flour fortification could help to address many of the micronutrient deficiencies among the broader Afghan population, WFP began to investigate the possibility of launching a micronutrient fortification programme in late 2002.

In November 2002, a comprehensive report was issued on ‘Flour Fortification Issues in Afghanistan’, which assessed the capacity of both small- and large-scale flour mills in Kabul and Mazar and advocated that flour fortification could, and should, be pursued on both levels in Afghanistan. Based on examples of flour fortification in Tajikistan where the situation was very similar to Afghanistan, the report proposed some potential fortification strategies as well as their likely costs.

Following these initial recommendations, a consultant from MI with substantial experience with small maize mills in southern Africa and large wheat mills in Pakistan, investigated the potential of small-scale mills in Kabul and Badakhshan.

Based on this work, it was proposed that flour fortification should commence in small-scale *chakki* mills as soon as possible. The mills, whether water or generator run, were regarded as suitable for manual fortification, i.e. adding the micronutrients (vitamins A, B1, B2, Niacin, Folate and the mineral Iron) by hand to the wheat grain while it is being milled and so producing fortified flour. Discussions were also pursued with some local millers, almost all of whom agreed to proceed with flour fortification.

Meanwhile, WFP asked MI to suggest ways of ensuring the long-term success and sustainability of flour fortification in Afghanistan, since WFP cannot guarantee funding for such a lengthy project. For this reason, MI India undertook a social marketing study on flour fortification. The resulting report ‘The Softer Side of Nation Rebuilding: Promoting Fortified foods in Afghanistan - A Social Marketing Approach’, argued that millers would need strategic support to help them create effective brand names in order to promote this new product. Furthermore, it was stressed that a national campaign to raise awareness among the population about the benefits of fortified flour would have to be undertaken by the MoPH, with the support of WFP.

On the basis of these reports and recommendations, the MoPH and WFP started a small-scale wheat flour fortification project in Kabul in March 2004. This pilot project was designed to be part of a broader fortification strategy developed by the MoPH.

The small-scale flour fortification project was funded by the Canadian International Development Agency (CIDA) under the Food Plus programme and funding for premix was

provided by MI. The project was implemented by WFP under the direct supervision of the MoPH in collaboration with other UN and international organizations such as International Assistance Mission and UNICEF. UNICEF also allocated some US\$20,000 for the implementation of the baseline survey.

The *chakki* mills in Afghanistan are not sophisticated enough to allow for the installation of a micro-feeder so WFP decided to pursue a different methodology, recommended by MI. A small amount of flour was combined with micronutrients to produce 500g packets of diluted premix, each sufficient to fortify 50kg of flour at the mills. To increase the efficiency of this process, a special manual mixer was designed, which can rapidly produce the diluted premix. Once the premix arrives, the millers simply add a 100g scoop of it to each 10kg bucket of wheat before pouring it all into the mill where it is thoroughly mixed together.

## Kabul

Sixteen small-scale *chakki* mills with a total capacity of 20 tons per day were contracted to fortify their flour, while a bread and cake factory with a capacity of 5 tons per day also signed up for the scheme. International Assistance Mission (IAM), an international non-governmental organization (NGO) with many years of experience in Afghanistan, was selected as WFP's implementing partner responsible for the dilution of the premix and the delivery of it to the millers as well as the monitoring of the programme. IAM sent a monthly report to the MoPH and WFP, along with a final report at the end of the six-month programme detailing production and

distribution figures as well as specific problems and recommendations. The results of these reports were used to improve production standards and raise consumer demand. MoPH personnel also conducted visits to the production site.

During the pilot project several problems were encountered. These were chiefly difficulties in ensuring full compliance with measurements and techniques by the millers and obstacles to promoting greater awareness of the benefits of fortification among the population.

Initially, WFP expected a considerably higher output of fortified flour (6,240MT planned versus 1,250MT actually produced). Large quantities of non-fortified flour (which is often cheaper than the locally produced flour) flow into Afghanistan from neighbouring countries, severely restricting the market for locally produced flour. In addition, Afghans prefer the refined 'white' flour imported from surrounding countries rather than local wheat, which many consumers do not regard as 'good wheat'. This preference for the abundant supplies of foreign wheat has hampered the growth and development of local milling and flour fortification activities in Kabul.

To try and change people's opinions and boost compliance at the mills, wide-ranging awareness activities were conducted. Forty thousand pamphlets were printed and distributed among the target population, families living near the mills. The pamphlets conveyed messages on behalf of the MoPH about the benefits of vitamins and minerals as well as basic information about the fortification project. Training was also provided to communities living near the location of mills on the importance of vitamins and minerals and the



Different stages in the production process in a chakki mill in Afghanistan: from adding a vitamin and mineral premix to whole wheat grains to the end product, a packet of fortified flour.

significant impact that fortification has on reducing micronutrient deficiencies.

The pilot project in Kabul ended on 31 December 2005. Despite the various constraints and hindrances, the small-scale mills in Kabul still managed to produce over 1,250 tons of fortified flour. Based on data on flour consumption in Afghanistan (500g per person per day; FAO, 2002) almost 4,000 people received locally produced fortified flour for 24 months.

## Badakhshan

A baseline survey was conducted prior to the start of the flour fortification programme in the

area. The survey was based on a random sample of 1000 women and 1000 children to assess the prevalence of anaemia and the iron levels in children under five and women aged 15-49. Furthermore, information on flour purchases, data on the dietary patterns of adults and children and clinical symptoms of micronutrient deficiencies were also collected.

The pilot project in Badakhshan began in June 2004 in 10 mills around the town of Faizabad, each with a daily capacity of 1 ton. An NGO, FOCUS, was contracted to dilute the premix and monitor the project on behalf of WFP and the MoPH. The project ran successfully for a few months but was suspended in September 2004 because a security incident forced FOCUS



to evacuate. The building and all the fortification equipment were held by local authorities until December when WFP was able to continue the project in 14 mills.

The pilot project in Badakhshan continued up to 30 April 2006, producing around 242 tons of fortified flour, after which the project was evaluated.

## Achievements

### 1. Millers increasingly willing to participate

The programme started with 14 millers and by the third month had expanded to 16 millers all of whom received training, equipment and materials needed for fortification. The millers' participation was voluntary and unpaid.

### 2. Wide consumer support, especially from women

Seventy percent of the people (both community and traders) who brought their wheat for milling were willing to fortify their flour. During the course of implementation of the programme from 14 December 2005 to 31 March 2006 on average 4,189 people received fortified flour every day for almost four months. One of the millers commented that fortification was gaining popularity amongst the people of his area and that people were requesting that the programme be expanded to other areas of Badakhshan.

### 3. Employment

Four widows were hired and trained to carry out the dilution of the premix with the flour.

## 4. Political support

The Mayor, the Director of Health and other authorities in Badakhshan saw flour fortification as an effective intervention to tackle micronutrient deficiencies. As part of publicity and awareness for the programme, the Mayor, the Director of Health and one miller, were interviewed on local TV and recounted their fortification experience to encourage other millers and the community to participate. The Director of Health encouraged the establishment of large-scale milling and fortification and silos as a more effective approach to reducing micronutrient deficiency strategies and covering of remote areas. He said establishing fortification capacity was a concrete, lifetime asset.

## Challenges

### 1. Preference for imported wheat

Most of the people preferred buying and consuming high quality flour produced by Kunduz Mazar and/or imported from neighbouring countries.

### 2. Relations with millers

No commercial incentive was available for millers. No plans were made to cover the fuel and maintenance costs for the equipment. Some millers looked at the fortification project as simply extra work and were unwilling to continue participation in the scheme.

### 3. Knowledge of benefits

Almost 55 percent of women interviewed knew nothing about flour fortification,

vitamins or minerals. Their men take the wheat for milling and they made no decisions regarding whether to fortify their wheat flour or not; however, after informing them about flour fortification and the benefits of vitamins and minerals, the women became interested and they committed themselves to fortifying their flour if they got the chance.

#### **4. Coverage**

Community leaders were concerned that the programme did not have wide coverage, especially in those districts which become isolated in winter and among those people who buy flour from the market and/or bread from the bakeries. It was suggested that the UN should also consider mass fortification of all locally produced and imported flour.

#### **5. Uneven supply and demand**

Peaks and gaps in flour production at small mills depended on accessibility and availability of wheat grain both at market and household level. The calculation for premix was based on the maximum capacity of the mills (2MT) and not the actual production per day (200kg-750kg) and as a result some of this expensive commodity was not immediately utilized and expired.

#### **6. Community consultation**

Before introducing a programme, a participatory approach should be considered and there should be wide consultation with different target groups such as authorities, community leaders, community people and the private sector.

## **Recommendations**

After the fortification programme ended in Badakshan, an appraisal mission evaluated the project and came up with lessons for future fortification programmes. The mission found sufficient evidence to conclude that fortification will have a significant impact on health indices in Afghanistan as it has in other countries. In addition, the mission agreed that flour fortification is both a practical and feasible solution to the micronutrient deficiencies of the Afghan population, particularly as bread is the staple food of most families, whether rich or poor.

However, the mission concluded that small-scale fortification is not the most effective means of introducing, and certainly not of expanding, flour fortification in Afghanistan, as this approach requires intensive and sustained interaction with many producers, while overall output is limited. At the same time, large-scale mills are becoming operational in Afghanistan, providing a more cost-efficient channel for the delivery of micronutrients to the population at large.

Considering these recommendations, WFP Afghanistan formulated a new plan to expand into large-scale flour fortification by working with the biggest commercial mills in major cities (Kabul, Mazar, Kunduz and Hirat).

### **Future plans: large-scale flour fortification**

When the small-scale fortification project began, no large mills were functioning in the country. Since then, several large-scale mills with modern technology have begun operating

in some of the bigger cities, including Kabul (160MT/day), Hirat (220MT/day), Mazar (200MT/day) and Kunduz (100MT/day). Involving these mills in fortification and enforcing legislation prohibiting the importation of unfortified flour will contribute greatly to reducing and potentially eliminating micronutrient deficiencies among the Afghan population, especially as almost everyone consumes bread on a daily basis.

Given the benefits of large-scale flour fortification in Afghanistan, WFP expanded its programme. The proposal, incorporated into WFP's current Protracted Relief and Recovery Operation for Afghanistan (2006-2008), called for WFP to subsidise the fortification premix for the next three years, although the subsidy will fall from 100 percent in 2006 to 25 percent in 2008.

Ideally, WFP hopes that the expanded programme will result in the fortification of 30,000 tons of micronutrient-enriched flour in 2006, rising ten-fold to 300,000 tons in 2008. The large-scale programme has started and considerable progress has been made.

- A comprehensive strategy paper for large-scale flour fortification has been prepared.
- WFP allocated US\$97,000 to renovate and upgrade the food analysis laboratory at the MoPH and contracted Grain Industry Alliance International (GIAI) to carry out this task. According to GIAI, the renovation work has already been done and the required equipment has arrived. The laboratory will now be able to measure the quality of the fortified flour in terms of micronutrient

content as well as the properties of the wheat grains before milling. The laboratory will be used for monitoring and quality control of both locally produced and imported fortified flour.

- A flour fortification task force has been established to oversee the fortification activities. Along with the MoPH and WFP, task force members are drawn from UNICEF, FAO, GIAI and other relevant ministries such as Finance, Commerce and the Ministry of Agriculture, Animal Husbandry & Food.
- The milling capacity and flow of flour into Afghanistan was thoroughly assessed. The data will help WFP and the MoPH to devise a concrete strategy and prioritise expenditure.
- A number of millers in Kabul, Mazar and Kunduz were visited as part of this assessment and they declared their full support for the fortification programme. One micro-feeder in Kunduz and two in Mazar have already been provided to large millers by WFP on a loan basis and other millers who commit to the project will receive similar equipment.
- WFP is also planning a major meeting to discuss the programme with millers from other regions, the government and relevant partners. The meeting will lay the groundwork for a Millers' Association and will emphasise the key role that millers can play in reducing micronutrient deficiencies across Afghanistan. Following this, an inter-ministerial meeting will be held to gain broader political support for the programme. Meanwhile, community leaders will be informed of the programme through the

proper government channels at each provincial level.

- A comprehensive advocacy and communication strategy, essential to the

long-term sustainability of the programme, has been designed and funding for this activity is being sought.

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## ANGOLA

Plagued by almost three decades of war, Angola has required external food assistance for many years. Once pronounced to be the worst country in the world in which to be a child, close to half of Angola's children aged under five, some 45 percent, have already had their growth stunted by malnutrition and related diseases.

Until just two years ago, the town of Kuito in Bie province was home to more than 100,000 IDPs, many of whom were almost entirely dependent on food aid for survival. The original residents of Kuito also found it difficult to cultivate their own food, with the front lines of the conflict nearby, fields littered with landmines and the town besieged for long periods.

In 1999, the NGO Médecines Sans Frontières (MSF) diagnosed the first case of pellagra, a disease caused by a deficiency in the micronutrient niacin, in Kuito. Pellagra is generally a rare condition, but it has been found in food emergencies in countries such as Malawi, Mozambique and Zimbabwe, all places where diets are monotonous and dominated by maize, which is low in niacin. Its symptoms are dermatitis, diarrhoea, dementia and sometimes death. In the following six months, 898 cases were

diagnosed, and by 2002, more than 3,800 cases of pellagra had been registered.

### Background

The growing pellagra outbreak prompted MSF and other organizations to distribute Vitamin B complex supplements for women. WFP began to distribute dried fish and in mid-2000 it began providing corn-soya blend (CSB) to therapeutic feeding centers and school feeding programmes, and to IDPs in 2001, in an effort to boost the intake of niacin and other essential micronutrients among its beneficiaries.

Unfortunately, these responses were insufficient to stem the outbreak. MSF reported that compliance with the Vitamin B supplements was low, and WFP's CSB rations were not available to the broader population. Since the basic diet of people in Bie was still limited mostly to maize, the cases of pellagra continued to grow.

Professor Mike Golden, an expert in nutrition in emergency situations, recommended that WFP fortify and mill maize upon arrival at the port of

Lobito, Angola, to redress the province's serious micronutrient problems.

## Local fortification

With approximately US\$2 million from CIDA, WFP purchased fortification equipment to be installed in a mill based in Lobito in 2003. A generator was also procured to guarantee power supply to the plant and a fortification supervisor was hired to oversee the project. UNICEF provided a vitamin pre-mix consisting of niacin, thiamine, riboflavin, folic acid, pyridoxine and iron.

The fortification equipment was installed at SOCITRAM, a mill in Lobito and a plan drawn up whereby SOCITRAM would pay for it out of proceeds from WFP contracts to produce fortified maize meal over a period of 10 years. In this way, the mill took on ownership and responsibility for the project and equipment, rather than viewing it only as a short-term donation.

By September 2004, the mill had overcome some teething problems and began producing fortified maize meal at the rate of 4 MT per hour. The quality of the maize meal was monitored on a daily basis, in addition to a monthly monitoring system.

## Achievements

### 1. Health and nutrition improvements

Between September 2004 and September 2006, almost 10,000 MT of fortified maize meal has been produced at the Lobito plant.

Approximately 115,000 beneficiaries receive this fortified meal every month, helping to protect them against future outbreaks of pellagra and other micronutrient deficiencies.

While isolated cases of pellagra continue to be reported, the widespread outbreak has been stemmed.

Studies undertaken indicated that:

- 29 percent of women in Kuito had low niacin levels according to a pellagra survey conducted with the Institute of Child Health in London.
- 53 percent of school aged children in Bie province were chronically malnourished (stunted) according to a baseline nutrition survey in April 2005 and 35 percent were underweight for their age; the survey will be repeated at the end of 2006 to check progress.

### 2. First fortification plant established in Angola

In a country where nutritional problems have festered for decades, the establishment of the first flour fortification plant may help address micronutrient deficiencies and other health conditions.

Despite several initial setbacks, WFP and its partners have succeeded in establishing:

- regular output of 4 MT of fortified maize meal per hour;
- a daily monitoring system at factory level checking the quantity of maize and vitamin premix being processed, as well as the colour, humidity levels and temperature of the output;

- a monthly monitoring system whereby samples of the fortified flour are tested at a laboratory to ensure the correct levels of vitamins and minerals have been added; and
- a dialogue with MI and the Government of Angola to incorporate fortification at the national level. This includes establishing regulations and standards for fortification in addition to training for technicians and other government officers.

The fact that this plant is now functioning smoothly has demonstrated WFP's capacity in this area, building confidence in the ability of similar health and nutrition interventions to succeed in difficult or transition environments.

The few initial problems in dealing with the private sector in a post-conflict situation, e.g. accounting standards, maintenance practices, employee health and safety requirements, were outweighed by the private sector's drive for efficiency and profit. WFP's large demand enabled it to negotiate good prices and as other companies enter the market it should become even more competitive and sustainable in the long term.

### **3. Improved synergy between UN agencies**

The collaboration between UNICEF and WFP worked well, with UNICEF supplying the vitamins and WFP supplying the equipment and distribution mechanisms. On the basis of this positive experience, the two agencies have expanded their work together to include education, water and

sanitation projects. WHO also provided assistance with deworming activities.

## **Challenges**

### **1. Supply**

Donations of maize or cash with which to buy maize are not always predictable. WFP's reliance on voluntary donations, plus changes in the Government of Angola's policy towards genetically modified foods meant that it was not always possible to guarantee a regular supply of maize to be fortified and distributed.

➤ Fortification of maize meal should be given priority in allocation of resources, given its vital role in preventing micronutrient malnutrition.

### **2. Shelf life**

A study conducted in June 2005 indicated that fortified maize meal in Angola lasts an average of six weeks to three months on the shelf, meaning that it needs to be procured, milled, transported, distributed and consumed during this time. It requires much closer attention from logistics, operations, and implementing partners to reduce unnecessary losses.

➤ Options for preservatives and improved packaging should be explored.

### **3. Operating conditions**

In a post-conflict situation, many factors outside WFP's control impact on its ability to deliver: limited implementing and commercial partners (including millers); damaged infrastructure; poor energy supply;

availability of replacement parts and maintenance technicians.

› A thorough feasibility study is required to assess the potential limitations posed by external factors before embarking on local milling and fortification.

#### 4. Quality control

A paucity of trained staff, clear standards, procedures and equipment meant much needed to be learned through experience.

› Normative guidance should be developed and qualified programme officers should be hired and trained.

### Recommendations

The successful implementation of this project in Angola's difficult post-conflict conditions proves that WFP can and should engage in fortification

of food at local level in such a context.

While health and nutrition are relatively new areas of expertise for many WFP staff, it is clear that the organization's experience in transitional situations positions it well to make a significant contribution to fortification and nutrition support, given adequate staff, guidance and funding.

However, since micronutrient deficiencies are nationwide, and given the return to a more stable political environment, WFP's role will now be shifting from a direct involvement in the implementation of milling and fortification activities to advocacy at national level for the government to develop regulations, set standards for flour fortification and stimulate the private sector to take on a bigger responsibility in this area.

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## ZAMBIA

### Background

In 2000, WFP and MI established a pilot project to test on-site milling and fortification in a remote refugee setting in Zambia, using a mobile containerized mill unit with a production output of approximately 1MT of fortified maize meal per hour. The aim was to assess the feasibility of this

approach, including technical, managerial and economic aspects, and to determine the impact of the approach on the nutritional status, and in particular micronutrient status of beneficiaries.

The Nangweshi refugee camp in Western Zambia was chosen as the site for the pilot project in December 2000<sup>1</sup>. CARE-Zambia, with

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1 Nangweshi Camp was chosen for several reasons:

- i) it is very isolated and hence a good test case for testing the feasibility of delivering and commissioning the MFU in a remote location;
- ii) compared with other camps it was stable from a management perspective; and
- iii) it was a new camp where the major portion of the food supplied was from WFP and thus the nutritional effects of micronutrient fortification could be easily monitored.

support from CARE-Canada, had been contracted by WFP and UNHCR to distribute food in this camp which was established in 2000 for Angolan refugees. To support the project's activities in Zambia, a National Task Force was also set up that included representatives from UNHCR, WFP, the Government of Zambia, CARE-Zambia, and two other NGOs, African Humanitarian Aid (AHA) and Christian Outreach Relief and Development (CORD). Two containerized MFUs were commissioned in August 2003 and have been in operation since then.

Nangweshi Camp is located in Shangombo district in the Western Province of Zambia. The main camp was established early in 2000 for 15,000 Angolan refugees. In 2002, an extension camp was established to accommodate an influx of new refugees. The nearest town, Senanga, is about 45 km away<sup>2</sup>.

Vehicle access to the camp is difficult and involves crossing the Zambezi by pontoon and driving through sandy soils. Access is particularly difficult during the rains and is dependent upon unreliable water transport from Senanga to the camp.

At the end of October 2003, there were approximately 26,500 refugees living in both camps. In addition, about 5,000 Zambian nationals lived within a 10 km radius of the camp. Approximately 20 percent of the camp's population was under 5 years of age and

40 percent between 5 and 17.

WFP provides food as well as funds to CARE-Zambia for general ration distribution and to AHA for supplementary feeding activities. It also supports groups engaged in production of empty bags and containers for income generation and maintains the warehouses and food distribution centers.

In July 2003, an anthropometric and micronutrient survey was conducted<sup>3</sup> in the camp to generate baseline data for assessing the nutritional and health impact of the MFUs. Overall, the anthropometric results for children under five indicated a relatively satisfactory overall nutrition status, but anaemia in under-fives and vitamin A deficiency among adolescents were cause for concern.

## **Maize distribution and milling prior to the start of the project**

WFP has supplied maize grain to the camp since it was established and maintains the grain supply. Maize is the main commodity provided to the refugees.

Within the camp, food rations<sup>4</sup>, including whole maize, were distributed every 15 days to refugee households. On the days of food distribution, one member of each family queued for their allocation of commodities according to the

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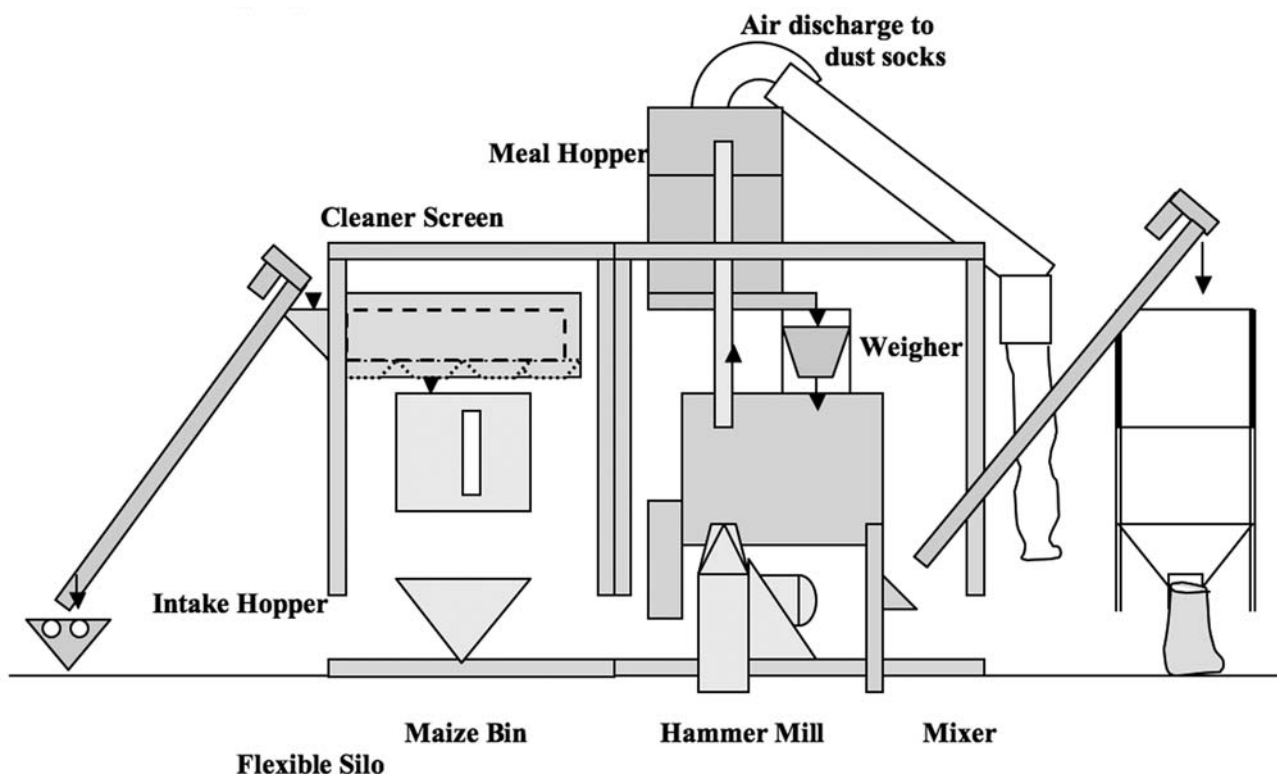
2 The total population of Shangombo district according to the Zambian 2000 census was 82,353 and the town of Senanga had a population of 110,063.

3 The survey was conducted by the Institute of Child Health, London, in collaboration with: the Tropical Disease Research Centre, Zambia; AHA; UNHCR; and CARE-Canada. Subjects were selected using systematic sampling based on house and population data supplied by UNHCR and CARE-Canada.

4 The Food Basket supplied by WFP was calculated using NutVal 2004 to provide on a per capita basis approximately 2154 kcal, 69 g of protein, 39 g fat and those micronutrients naturally present in the commodities supplied. Oil is generally fortified with vitamin A but this cannot always be guaranteed. Rations were composed of: maize grain - 450 g; beans - 120 g; vegetable oil - 20 g; and salt - 10 g. In addition, high energy protein supplements and dried skim milk are provided for use in supplementary and therapeutic feeding activities.



## Mobile Mill and Fortification Unit - Side View



block in which their dwelling was administered.

Prior to the launch of the pilot milling and fortification project, bags of whole maize were either taken home for cleaning or taken directly to one of the hammer mills operating in the camp. The amount of maize brought to be milled ranged from 10 to 35 kg per household, and people sometimes queued for 6 – 8 hours or had to return on subsequent days.

There were seven of these small diesel powered hammer mills located in the camp when the project started. The typical output of each mill was 150-200 kg/hour<sup>5</sup>. Each hammer mill was overseen by a refugee supervisor and received some support for mill maintenance and daily fuel allocations. Refugee women operated the

mills and were paid for their work. The mills, however, frequently broke down due to their high workload. For example, during the initial feasibility mission in May 2001, only half of the hammer mills in the camp were operational.

## Local food fortification

WFP, MI and the Natural Resources Institute (UK) established the design criteria for the MFUs. It must:

1. meet the needs of a population of 13,500 refugees, each consuming 0.4 kg of milled and fortified maize meal a day;
2. produce a product that was at least as good as the maize meal obtained from the small scale hammer mills;

<sup>5</sup> The technical grinding capacity of the mills was around 350 kg/hour but owing to the amount of wear they get and their overall mechanical conditions a more typical output was between 150 and 200 kg/ hour.

3. ensure that generally accepted quality standards would be met; and
4. be easy to transport and commission without specialized knowledge or equipment.

The fortification premix was agreed upon between the various partners involved and the Government of Zambia and included vitamins A, B1, B2, B6, B12, iron, zinc, niacin and folic acid.

## Introduction of milled and fortified meal to the camp

The transition from a situation where the refugees were provided with whole maize which they then took to be milled, to the new situation where they received fortified maize meal required careful community sensitization. The refugees initially expressed considerable skepticism about the addition of something to their food at community meetings. The concerns they raised included the following:

- maize meal would taste bitter;
- food fortification would make men sexually weak, children would experience stunted growth, and pregnancies would end in abortions;
- those that would eat the fortified product would die slowly after two years because white people have many ways in which they kill Africans; and
- food fortification might transmit HIV from Zambians to Angolans or would bring unknown diseases, including blindness in old people.

In response to these concerns, the implementing partners (CORD, AHA) supported a number of sensitization activities. These included:

- a visit by community leaders to a mill in Lusaka

that was fortifying maize meal and to three community fortification projects where they had a chance to talk to people using fortified meal and to those doing the fortification;

- community meetings and one-to-one outreach; and
- distribution of Information, Education and Communication (IEC) materials

***The Lusaka Tour:*** two camp council leaders went to Lusaka to visit a mill where fortification was in place and met with consumers in Lusaka's peri-urban area. The leaders came back from this trip convinced of the benefits of fortification and most of the refugee population were happy to accept it.

***Community meetings and one-to-one outreach:*** after spending two days learning about fortification and how to develop key messages to share with the community, the Community Development Workers (CDWs) played a key role in sensitising the community on the importance of having foods like sugar and maize meal fortified and responding to questions and observations. The CDWs also put together a short drama which they performed at public places such as markets, food distribution centre and clinics. Other groups in the community that were also involved in these activities were the traditional dancers, footballers and the camp leaders.

***Distribution of IEC materials:*** IEC materials (posters and brochures) were locally designed, printed and distributed to refugees and other publicity materials were placed in strategic places such as the community information centres in the main and extension camps. Printed t-shirts, caps and football shirts with messages about fortification were also distributed.

## The first year of operations

A milling coordinator was appointed by CARE-Zambia to be responsible for the overall management of the MFUs along with two MFU supervisors to oversee the day-to-day operation of machinery and staff. In addition, a mill mechanic would be responsible for repairing and maintaining the mills.

The supervisors were initially reticent to operate the mills due to their size and apparent complexity compared with the simple hammer mills with which they were familiar. However, within one day of training they were operating the units without assistance. Each MFU now has one supervisor and 6 staff (men and women) who can control the milling and fortification process from the control panel.

Both MFUs have been operating for 6 hours per day for 26 days per month to meet the camp's requirement for fortified grain and no accidents have been reported since the start of operations.

## Achievements

### 1. Food distribution and consumer perceptions

Food rations continue to be distributed twice a month. However, with the introduction of the MFU's ration sizes were reduced. There have not been any problems linked to the reduction in the weight of rations as:

- a. refugees were probably losing an equal amount of maize, if not more, when they took their whole maize to the hammer mills to be ground; and
- b. refugees no longer have to queue to

have their grain milled.

The time saved has been much appreciated by the refugees and has resulted in people, especially women and girls, having more time to attend to other household and family tasks or to attend school or courses.

### 2. Employment opportunities

Prior to the introduction of the MFUs the seven hammer mills operating in the camp employed over 40 people. With the introduction of the two MFUs the total number of people employed to supervise and operate the mills fell to 26 (22 refugees and 4 Zambian nationals). These individuals have acquired new and more sophisticated skills and knowledge through on-the-job training in the assembly of the plant, its operations, hygiene, first-aid and safety education.

### 3. Health and nutritional status of the camp population

In various discussions during an evaluation mission, the refugees and the NGO implementing partners reported a considerable improvement in health and nutritional status since the MFUs became operational. In particular, women and children were said to be stronger and less frequently ill, pregnancy outcomes improved, and there were also reports of very specific improvements of, for example, poor sight in pregnant women. In fact, the community sensitization may also have created some unrealistically high expectations as refugees were now wondering: "why should children still be getting sick?" and "why do old people not see well?"

Results of the nutrition follow-up survey shows that the introduction of fortified maize was

associated with improvements in the micronutrient and anthropometry status of children and adolescents after a period of 12 months: anaemia in children decreased from 47.7 to 24.3 percent, while vitamin A deficiency (which was measured in adolescents only) decreased from 46.4 to 20.3 percent. There was also a significant decrease in chronic malnutrition (stunting) in under-fives between the baseline and follow-up study, from 50.0 to 41.1 percent.

## Findings

The Nangweshi pilot project was set up to test the feasibility of on-site milling and fortification with a view to delivering micronutrient sufficient rations to food-aid dependent populations in hard to reach emergency settings.

In considering which approach to use for providing a fortified cereal flour, there are a number of issues that need to be addressed. These include: isolation of the camp; availability of technical and managerial skills; and, funding requirements in terms of initial costs and running costs.

In camps that are easy to reach, private millers may be able to guarantee regular supplies of fortified milled grain. As a result, assessing the capacity of the private sector should be an essential part of all prior assessments of potential supply channels for fortified meal.

In camps that are difficult to reach, wholegrain needs to be milled on-site and hence also fortified on-site, unless alternative approaches,

such as the use of multimicronutrient formulations, packed for individual or household use, are feasible.

If there is a large local population, then it may be possible to invest in or support the development of local private sector milling capacity. However, where there is no local market or the local market is very small it is unlikely that milling and fortifying locally would be sustainable once a camp closes.

The project has shown that it is possible to commission and successfully run an MFU in an isolated refugee camp setting. The technical and managerial requirements were equivalent to those required by any food processing operation and included the following skills: mechanical and electrical engineering, planning, supply-chain management, financial control, and quality management.

## Recommendations

The Nangweshi project has shown that centralized on-site milling and fortification in a remote refugee camp using a containerized milling and fortification unit is feasible from a technical and managerial point of view. The MFU's have been operational for three years now without major problems. The approach also proves to be a cost-effective way of providing beneficiaries with a freshly<sup>6</sup> milled and fortified flour of good quality.

The transition from decentralized milling, where refugees took their grain to a hammer mill, to centralized milling and fortification

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<sup>6</sup> Wholemeal maize flour has a short shelf life and turns rancid rather quickly. The time lapse between milling and consumption in the current setup is no longer than two weeks, whereas it may be considerably longer if the maize is milled elsewhere, given the transport constraints.

required the implementing partners in the camp to take on new roles and responsibilities. The partners have shown that integrating such a new initiative within normal day-to-day camp management is feasible and that in doing so the partners acquire new managerial and technical skills. Refugees have been involved as workers in the milling operations and have, under the guidance and management of CARE-Zambia, adapted well and with pride to working with more sophisticated and complex equipment than they were used to.

Getting both the government and the leadership of the refugee community actively involved at an early stage helped pave the way for a smooth transition from distribution of whole maize grains to a fortified maize meal through, for instance, agreements on fortification levels and refugee employment as well as soliciting community support.

Given the involvement of refugees in the milling and fortification of their own maize, proper community sensitization was particularly important. The sensitization activities carried out by AHA and CORD aimed at removing uncertainties with respect to the addition of unknown substances to their food, were very effective, resulting in the refugee community being very supportive towards the new arrangement.

At the time of the evaluation, perceptions of positive outcomes were noted among the refugees, especially in terms of health of women and children. In addition, the refugees and the camp staff reported significant saving of time

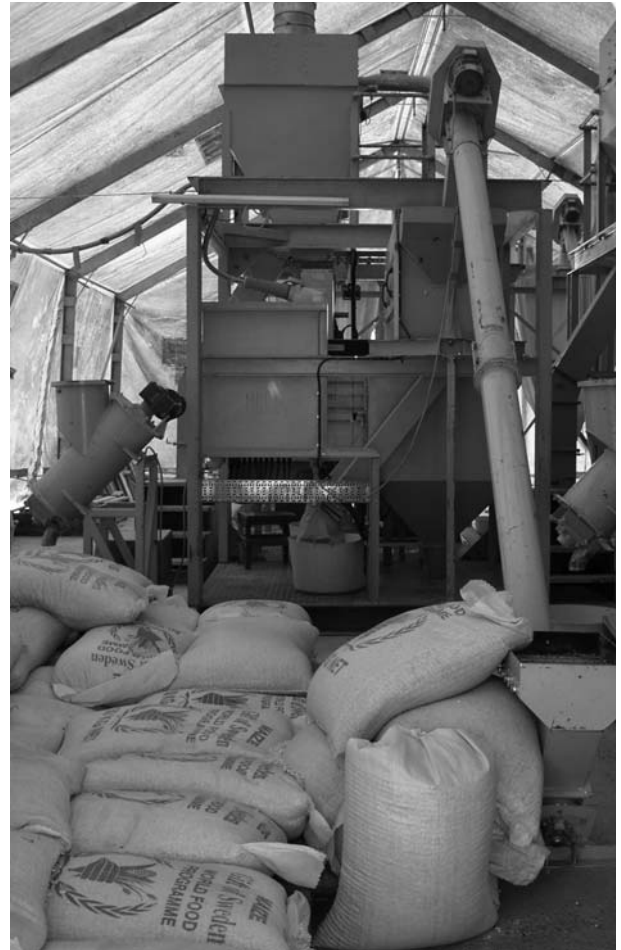
by refugees as they no longer had to queue to have their grain milled.

Results of the nutrition surveys do indeed show that the introduction of fortified maize was associated with improvements in the micronutrient and anthropometric status of children and adolescents: anaemia in children under five was halved, while vitamin A deficiency in adolescents decreased significantly. There was also a significant decrease in chronic malnutrition in under-fives<sup>7</sup>.

Apart from the cooperative attitude of the beneficiaries, the success of the Nangweshi on-site milling and fortification project is largely due to the efforts of the many actors involved both nationally and internationally who have worked closely together to take the idea of a mobile, containerized mill and fortification unit and turn it into a working pilot project in less than three years. In particular, the project has provided the country office in Zambia with the experience and motivation to embark on a new, similar initiative: as the refugees from the Nangweshi camp are currently being repatriated to Angola, the milling and fortification equipment will be redeployed in a camp for Congolese refugees in Northern Zambia, where it will be used for the milling and fortification of locally procured cassava.

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<sup>7</sup> Full details are given in a separate report 'Evaluation of the nutritional impact of on-site milling and fortification in Nangweshi Refugee Camp, Zambia' April 2005.



The mill in Nangweshi, Zambia, set up in a Rubhall

## ACRONYMS

<b>AHA</b>	African Humanitarian Aid	<b>IDPs</b>	Internally Displaced People
<b>CDWs</b>	Community Development Workers	<b>IEC</b>	Information, Education and Communication
<b>CIDA</b>	Canadian International Development Agency	<b>MFUs</b>	Milling and Fortification Units
<b>CORD</b>	Christian Outreach Relief and Development	<b>MI</b>	Micronutrient Initiative
<b>CSB</b>	Corn-soya blend	<b>MoPH</b>	Ministry of Public Health
<b>FAO</b>	Food and Agriculture Organization	<b>MSF</b>	Médecines Sans Frontières
<b>GIAI</b>	Grain Industry Alliance International	<b>NGO</b>	Non-governmental organization
<b>IAM</b>	International Assistance Mission	<b>UNHCR</b>	United Nations High Commissioner for Refugees
<b>IDA</b>	Iron deficiency anaemia	<b>UNICEF</b>	United Nations Children's Fund
		<b>WFP</b>	World Food Programme
		<b>WHO</b>	World Health Organization





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