Acceptability of Two Ready-to-Use Therapeutic Foods among HIV-Positive Patients in Vietnam

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Contents

Abbreviations and Acronyms

AIDS	Acquired Immunodeficiency Syndrome
ART	antiretroviral therapy
ARV	antiretroviral drug
BMI	body mass index
BMIZ	BMI-for-age z-score
CFU	colony-forming units
FANTA	Food and Nutrition Technical Assistance III Project
g	gram(s)
HAZ	height-for-age z-score
HEBI	High-Energy Bar for Integrated Management of Acute Malnutrition
HIV	human immunodeficiency virus
IDU	intravenous drug user
IMAM	Integrated Management of Acute Malnutrition
IRD	Institut de recherche pour le développement
kcal	kilocalorie(s)
kg	kilogram(s)
kJ	kilojoule(s)
L	liter(s)
MT	metric ton(s)
MUAC	mid-upper arm circumference
NGO	nongovernmental organization
NIN	National Institute of Nutrition
OPC	HIV outpatient clinic
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PLHIV	person or people living with HIV
PMTCT	prevention of mother-to-child transmission of HIV
RUTF	ready-to-use therapeutic food
SAM	severe acute malnutrition
TB	tuberculosis
UNAIDS	Joint United Nations Programme on HIV/AIDS
VAAC	Vietnam Administration of HIV/AIDS Control
WAZ	weight-for-age z-score
WHO	World Health Organization
WHZ	weight-for-height z-score

Executive Summary

Weight loss and malnutrition are associated with HIV and AIDS, and low body mass index (BMI) at diagnosis of HIV infection significantly increases the risk of mortality (van der Sande et al. 2004). Chronic weight loss occurs in around 20 percent of patients with AIDS, and severe weight loss is one of the strongest indicators associated with morbidity and reduced survival, even with antiretroviral therapy (ART). A WHO review of the evidence found several studies that demonstrated the positive effects of macronutrient supplementation on weight gain and adherence to medication in people living with HIV (PLHIV) (Willumsen 2013). However, the evidence, especially with regard to macronutrient supplementation and its effect on weight gain and disease progression in PLHIV, mainly comes from studies conducted in Africa, and data are lacking from Asia.

Vietnam's HIV prevalence is low, estimated at 0.45 percent among people 15–49 years old in 2011 (Ministry of Health 2011), although this figure means a significant number of HIV-positive individuals in a population of almost 89 million (General Statistics Office of Vietnam 2012). HIV is largely concentrated among intravenous drug users (IDUs), female sex workers, and men who have sex with men, along with their partners and clients, although prevalence is increasing in the general population.

Ready-to-use therapeutic food (RUTF) has been found to be a highly effective and relatively inexpensive intervention to treat severe acute malnutrition (SAM) among people with or without HIV. The most commonly used RUTF for this purpose has been the peanut-based Plumpy'Nut produced by Nutriset. A 2009 socio-anthropological investigation in Cambodia observed low adherence to a Plumpy'Nut regimen among children 6–10 years old with different levels of undernutrition. In addition to acceptability issues, there were communication and infrastructure problems in the communities exposed to Plumpy'Nut that were unrelated to taste and acceptability. Because of the negative findings of this investigation and the high cost of importing RUTF in Vietnam, the National Institute of Nutrition (NIN), the Institut de recherche pour le développement (IRD), and UNICEF collaborated in 2009 to formulate a rice/soy/mung bean-based RUTF that could be produced locally. The product of this effort is called High-Energy Bar for Integrated Management of Acute Malnutrition (HEBI). In 2010 a small acceptability study conducted among moderately malnourished HIV-negative preschool-age children in Vietnam concluded that HEBI was sufficiently acceptable to be considered a potential intervention for this population (Trần et al. 2013).

With funding from U.S. President's Emergency Plan for AIDS Relief (PEPFAR)/Vietnam and technical support from the Food and Nutrition Technical Assistance III Project (FANTA), IRD collaborated with NIN in 2011 to study the comparative acceptability of Plumpy'Nut and the locally produced HEBI among children and adults with HIV. The study focused on assessing the products' acceptability (defined as 50 percent or more of the prescribed dose consumed) and organoleptic properties, such as taste and texture. Because acceptability, taste, and texture preferences may differ between children and adults, two studies were conducted simultaneously, one with 80 HIV-positive children 3–7 years of age attending the National Pediatric Hospital in Hanoi and one with 80 HIV-positive adults attending the Hospital for Tropical Diseases in Ho Chi Minh City. This report presents the results of these two studies.

Methods

Each of the studies was carried out as a randomized crossover study in which HIV-positive participants were randomly divided into two groups of approximately 40 each. Each group was randomly assigned to receive either Plumpy'Nut or HEBI during the first 2 weeks and the other product for the subsequent 2 weeks. In addition, a third group of approximately 40 HIV-positive participants in each study was randomly assigned to be in the comparison group, which did not receive any products during the study. Each serving of Plumpy'Nut (92 g sachet) and HEBI (bar) provided the same amount of energy (500 kcal). The daily dose prescribed to the children was one serving of RUTF (500 kcal/day), and the daily dose prescribed to the adults was two servings of RUTF (1,000 kcal/day).

NIN trained nurses in the two hospitals in the assessment protocol, including how to use the RUTF; how to measure height, weight, and mid-upper arm circumference (MUAC); and how to calculate BMI for adults and weight-for-age z-score (WAZ), weight-for-height z-score (WHZ), and BMI-for-age z-score (BMIZ) for children. Subjects were asked to return to the hospital every week for anthropometric measurement. Subjects or caregivers closely monitored daily RUTF intake and any side effects of the RUTF using a standardized intake form. An intake of 50 percent or more of the total 2-week amount of RUTF distributed was defined as acceptable for both products, and the researchers defined a 20 percentage point or more difference in acceptability between the two products as important to detect.

Findings

The children in the study consumed 69 percent of the 2-week dose of HEBI and 65 percent of the 2-week dose of Plumpy'Nut ($p=0.13$). Many children did not respond when asked which of the two RUTFs they preferred. On average, they did not rate the organoleptic properties of the RUTFs differently. Children who indicated a preference tended to prefer HEBI (65 percent) to Plumpy'Nut (35 percent) ($p=0.058$).

Adults consumed 91 percent of the 2-week dose of HEBI and 81 percent of the 2-week dose of Plumpy'Nut ($p= 0.059$). The 10 percentage point difference between HEBI and Plumpy'Nut in the results observed among adults was not statistically significant at $p=<0.05$ but could be meaningful in clinical settings. Despite a lack of statistical difference in adult participants' assessment of the organoleptic properties of the two RUTFs (except for a preference for HEBI's texture), adults overwhelmingly preferred HEBI to Plumpy'Nut (79 percent vs. 21 percent, $p=<0.0001$).

Over the 4-week study period, significant gains in percent weight ($p=0.035$), WAZ ($p=0.014$), and BMIZ ($p=0.036$) were observed in the children who received RUTF compared with the children randomly assigned to the control group who did not receive RUTF. Significant gains in percent weight ($p=0.017$) and BMI ($p=0.0048$) were observed among the adults who received RUTF compared with the adults who did not. The study was not powered to determine whether weight gain or anthropometric indicators differed between the two RUTF for children or adults.

Recommendations

Both HEBI and Plumpy'Nut were acceptable to the sample of children and adults living with HIV in Vietnam who were included in this study. Children tended to prefer HEBI over Plumpy'Nut, and adults indicated a strong preference for HEBI. In 2012 UNICEF conducted a General Manufacturing Practices inspection of NINFOOD, which produces HEBI, and based on the positive results, accepted the use of the

product for the domestic market. Plumpy'Nut could be used while HEBI production increases to meet the demands of malnourished PLHIV in Vietnam. Patients and health care providers should receive appropriate information and education on its intended purpose and appropriate use.

1 HIV in Vietnam

Although Vietnam's HIV prevalence is low, estimated at 0.45 percent among people 15–49 years old in 2011 (Ministry of Health 2011), in a population of almost 89 million (General Statistics Office of Vietnam 2012), this percentage translates into hundreds of thousands of people living with HIV (PLHIV). HIV in Vietnam is largely concentrated among intravenous drug users (IDUs), female sex workers, and men who have sex with men, along with their partners and clients, although prevalence is increasing in the general population. Prevalence varies by province and is highest among IDUs in Quảng Ninh (56 percent), Ho Chi Minh City (55 percent), and Cần Thơ (45 percent) (Ministry of Health 2011). Prevalence also varies between urban and rural areas.

While HIV is mainly transmitted in Vietnam through needles and other equipment shared among IDUs, HIV transmission through heterosexual intercourse is increasing because of the spread of HIV from infected IDUs and clients of sex workers to their spouses or other regular partners. Although men accounted for 73.2 percent of all reported cases of HIV in 2009, the proportion of women living with HIV appears to be increasing (Vietnam National Institute of Hygiene and Epidemiology 2009). Annual sentinel surveillance data from antenatal clinics show that HIV infection among women, while still low, increased by more than 20 times between 1994 and 2007, from 0.02 percent to 0.53 percent (WHO and UNAIDS 2008). In coming years, Vietnam will likely see a rise in the number of children infected with HIV during pregnancy, labor, or delivery or through breastfeeding.

Since 2005 there has been a rapid scale-up of antiretroviral drugs (ARVs) in Vietnam. By 2009, 53.7 percent of adults with HIV were receiving ART (VAAC 2009). With new infections and increased access to ART to prolong life, the number of PLHIV and the proportion of PLHIV with access to ART are expected to increase.

2 Nutrition Interventions for People with HIV

At the beginning of the HIV epidemic, AIDS was called "slim disease," emphasizing the close link between malnutrition and HIV infection (Kiure and Fawzi 2004). Initially, chronic diarrhea and malabsorption caused by the virus were thought to cause malnutrition in PLHIV, but it is now known that many factors are involved. These include reduced food intake as a result of anorexia and altered taste, malabsorption as a result of villous atrophy, intestinal dysmobility and ileal absorptive dysfunction (cryptosporidial infection), and metabolic factors such as increase in energy expenditure and an altered response to nutrition. Also, HIV-induced enteropathy, independent of other infections, causes malabsorption and loss of small intestinal function leading to malnutrition in itself (Ullrich et al. 1989).

The role of nutrition in HIV is complex. HIV infection leads to malnutrition, and malnutrition contributes to faster progression to World Health Organization (WHO) Stages III and IV of AIDS (Friis 2002). Asymptomatic HIV infection increases resting metabolic rate by approximately 10 percent, and symptomatic HIV infection increases resting metabolic rate by 20–30 percent (WHO 2003). Hence, weight loss and malnutrition are common features of HIV infection and AIDS, and low body mass index (BMI) at diagnosis of HIV infection significantly increases the risk of mortality (van der Sande et al. 2004).

Weight loss of 10–15 kg is common in adults with HIV. Nutritional support normally results in some weight gain, but this weight gain is usually only partial, with little recovery of lean body mass. Severe weight loss is one of the strongest indicators associated with morbidity and reduced survival of PLHIV (Kotler 1997; Wheeler et al. 1998), regardless of antiretroviral therapy (ART) (Paton et al. 2006). In HIV-positive children, low daily energy intake has been associated with higher viral load (Arpadi et al. 2000). In HIV-positive women, low serum albumin concentrations (< 35 g/L), an indicator of overall nutritional status, was found to have a threefold higher risk of mortality than albumin concentrations > 42 g/L during a 3-year follow-up (Feldman et al. 2003). Severity of HIV-related weight loss is inversely correlated with CD4+ cell counts in HIV infection (Mangili et al. 2006). One study found an 11 percent increase in mortality with each 1 percent loss in body weight since the previous clinical visit (Mangili et al. 2006).

The World Health Organization (WHO) recommends that PLHIV consume more energy than people without HIV, as shown in Table 1. Micronutrient requirements are the same for people with and without HIV.

Table 1. WHO recommended increases in daily requirements for people with HIV

Nutritional requirement	HIV-positive children 6–59 months old (kcal/day)	HIV-positive children with weight loss (kcal/day)	HIV-positive adults (kcal/day)
Macronutrients (asymptomatic phase)	10% increase	50%–100% increase	10% increase
Macronutrients (symptomatic phase)	20%–30% increase	50%–100% increase	20%–30% increase

Source: WHO. 2003.

HIV-associated malabsorption of nutrients commonly leads to wasting. HIV infection produces atrophy of the small intestine enterocytes (Ullrich et al. 1989), which exacerbates malabsorption. Initial weight loss is thought to result mainly from this decreased absorption (Friis 2002). However, as HIV infection progresses, a compromised immune system can lead to opportunistic infections resulting in chronic diarrhea (Ullrich et al. 1989). Even in developed countries, 90 percent of HIV patients develop chronic diarrhea (Smith et al. 1992). Once these infections are established in the gastrointestinal tract, trauma to the epithelial tissue continues, decreasing the absorption of micronutrients (Kiure and Fawzi 2004). In the later stages of HIV infection, increasing viral load is associated with nausea and anorexia, further contributing to lower caloric intake (Macallan et al. 1995).

For children, the relationship between HIV infection and malnutrition is even stronger, with a dramatic inverse relationship between the progression of HIV infection and growth rate, energy intake, and fat free mass (Arpadi et al. 2000). Children with HIV find it difficult to meet their normal energy requirements (Arpadi et al. 2000), much less the higher WHO energy recommendations for PLHIV (see Table 1).

Surprisingly, few interventions have studied the effect of macronutrient supplementation on weight gain (Ndekha et al. 2009) and disease progression in PLHIV, and those in developing countries are difficult to compare because of their different outcome parameters.

Research has been far more extensive on the role of vitamins and trace elements in HIV infection. Observational studies show associations between low serum concentrations of vitamin A, vitamin E, vitamin B_{12}, and zinc and disease progression and/or negative health outcomes (Semba et al. 1995; Tang et al. 1997). A large randomized controlled trial in Tanzania showed that multiple micronutrient supplementation (vitamins A, C, E, and several B vitamins) increased CD4+ and CD8+ cell count, but vitamin A alone had no effect (Fawzi et al. 2004). In a different study, high-dose vitamin A supplementation of pregnant women appeared to increase the risk of mother-to-child transmission in Tanzania (Fawzi et al. 2002), but the same effect was not observed in a study carried out in South Africa (Coutsoudis et al. 1999). A study in Zambia failed to show a positive effect of supplementation with multiple micronutrients (vitamins A, C, and E, selenium, and zinc) on persistent diarrhea in HIV-positive adults (Kelly et al. 2008), but HIV-positive TB patients in Tanzania had a 70 percent reduction in mortality when they were given a mix of micronutrients including zinc (Range et al. 2006), and, in a separate study, provision of daily multivitamin supplements to HIV-positive women in Tanzania was shown to reduce the risk of death by 50 percent (Fawzi et al. 2004). Because some micronutrients (especially vitamin A and iron) in higher doses have been associated with negative outcomes (Fawzi et al. 2002; Sazawal et al. 2006), it would seem prudent to use lower, more physiological doses (minimum doses needed to produce a physiological effect in the body) for interventions targeted to PLHIV.

Data are lacking on the effects of nutrition interventions on HIV disease progression in Asia (Forrester and Sztam 2011). Most research has been done in sub-Saharan Africa, where underlying micronutrient deficiencies and nutritional status are likely to be different. Evidence from studies in Haiti, Kenya, and Malawi have demonstrated the positive effects of macronutrient supplements on weight gain and adherence to medication in PLHIV (Willumsen 2013; Ivers et al. 2010; Ndekha et al. 2009; Gichunge et al. 2010). Nutrition interventions can also improve quality of life by improving fitness and well-being, increasing wage-earning potential, and empowering PLHIV to take care of their physical needs both before and during ART (Kotler 1997).

3 Ready-to-Use Therapeutic Foods to Improve Nutritional Status in People with Severe Malnutrition in Vietnam

Ready-to-use therapeutic foods (RUTFs) are edible, homogenized, energy-dense, lipid-based foods with added vitamins and minerals. These products have been studied extensively and validated as a viable intervention and treatment for people with severe acute malnutrition (SAM) (Manary 2006). RUTF has been shown to improve the nutritional status of children living with HIV (Ndekha et al. 2005) and is easy to eat for adults with mouth sores or other HIV-related symptoms. As the name implies, RUTF does not need to be prepared before consumption, making it practical where cooking fuel and sanitary cooking facilities are limited. Because RUTF is not water based, it does not risk significant bacterial growth and the foods can be stored and used safely at home and used in community-based management of acute malnutrition. RUTF has a very high energy density, about 23 kJ/g (5.5 kcal/g) (Manary 2006) and a nutrient content similar to that of F-100 therapeutic milk, which is used in hospital settings to treat severe malnutrition. RUTFs can be made with local ingredients to fit local taste preference, although most of the RUTF consumed today is made in Europe. An example is Plumpy'Nut, a mixture of milk powder, vegetable oil, sugar, peanut butter, and powdered vitamins and minerals produced by Nutriset in France.

If safe, palatable RUTF with high energy content and adequate vitamins and minerals is available, children with SAM and no medical complications can be treated at home, with regular visits to health centers for monitoring. Home-based treatment of uncomplicated SAM in children has been proven as successful as, or even better than, hospital-based treatment (Linneman et al. 2007). Home-based interventions with RUTF also have the added benefit of putting less burden on the health care system (Collins et al. 2006).

Although RUTFs have been found highly effective in treating SAM, the acceptability of such products and their use according to a prescribed regimen can vary in populations with severe malnutrition (Boudier 2009). For example, a 2009 socio-anthropological investigation in Cambodia, a Southeast Asian country with a taste palate in some ways similar to that of Vietnam, found low adherence[1] to a peanut-based, imported RUTF regimen among children of various age groups and degrees of malnutrition, even though the RUTF was distributed free of charge (ibid.). However, that same study also identified problems with the introduction of Plumpy'Nut to the population, including a lack of social and behavior change communication to build support for RUTF in the community and within the health system, lack of communication with caregivers, lack of follow-up with patients, and lack of a referral system for patients with SAM.

In 2009 the National Institute of Nutrition (NIN), the Institut de recherché pour le développement (IRD)/Vietnam, and UNICEF collaborated to formulate an RUTF adapted to Vietnamese taste using locally available cereals and legumes and a vitamin/mineral premix. The intention was to find an alternative to commercially available, imported RUTF that was too expensive to be sustainable over the long term. The resulting product was called High-Energy Bar for Integrated Management of Acute Malnutrition (HEBI). The main difference between HEBI and Plumpy'Nut is that HEBI is based on rice, soybeans, and mung beans instead of peanuts (Table 2).

[1] Adherence in this study was defined as consumption levels close to the prescribed levels.

Table 2. Ingredients of HEBI and peanut-based RUTF

Ingredient (g/100 g)	HEBI (%)	Typical peanut-based RUTF (%)
Mung bean flour	8.55	0.0
Extruded rice (4% sesame)	6.2	0.0
Maltodextrin	9.75	0.0
Roasted soy bean powder	12.2	0.0
Peanut butter	0.0	25.0
Whole milk powder	8.6	30.0
Sugar powder	15.35	28.0
Canola oil	15.45	Vegetable oil 15.0
Vegetable shortening	8.15	
Lipid powder	8.6	0.0
Whey protein	7.0	0.0
Premix	0.15	1.5
Total	**100**	**100**

Source: UNICEF/Vietnam 2011; Manary, M. 2006.

A 2010 study in Hà Nam Province in Vietnam compared the acceptability of HEBI and Plumpy'Nut among 67 HIV-negative children 3–5 years old with moderate malnutrition (weight-for-height z-score [WHZ] between –1 and –3). Children were randomized into two groups that received either Plumpy'Nut or HEBI for the first 2 weeks and the other RUTF for the final 2 weeks of the study. Consumption and organoleptic ratings of both Plumpy'Nut and HEBI were found to be acceptable. Children showed a mean weight gain of over 600 g and a mid-upper arm circumference (MUAC) gain of 0.5 cm during the 4-week trial (Trần et al. 2013).

In 2012 UNICEF conducted a General Manufacturing Practices inspection of NINFOOD, which produces HEBI, and accepted the use of the product for the domestic market. The annual production capacity of HEBI was estimated at 140 metric tons (MT). UNICEF will consider NINFOOD as one of its international suppliers when the annual capacity has reached the threshold of 500 MT.

Although Plumpy'Nut and HEBI differ with respect to taste, appearance, and packaging, the two RUTFs are similar in energy density and vitamin and mineral content. HEBI also complies with UNICEF RUTF product specifications (Table 3).

Table 3. Comparison of UNICEF RUTF requirements and HEBI specifications

Component	UNICEF product specifications for RUTF	HEBI specifications
Energy	520–550 kcal/100 g	547 kcal/100 g
Weight	92 g/sachet	92 g/sachet
Protein	> 50% from milk 10%–12% kcal	52.4% from milk 12% kcal
Lipids	45%–60% kcal n-6 fatty acids: 3%–10% kcal n-3 fatty acids: 0.3–2.5% kcal	58.7% kcal n-6 fatty acids: 8.8% n-3 fatty acids: 2.2%
Moisture content	< 2.5%	2.4%
Heavy metals	None	Lead: None detected Cadmium: None detected Arsenic: 0.02 mg/kg Mercury: 0.01 mg/kg
Pesticides	No hazardous levels	None detected
Micro-organism count	< 10,000 CFU/g	450 CFU/g

Source: UNICEF/Vietnam and NIN. 2011.

4 Objectives of the Acceptability Study

With support from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), NIN developed *National Guidelines for Nutrition Care and Support of People Living with HIV* (Ministry of Health, NIN, and Vietnam Administration of HIV/AIDS Control, Vietnam. 2012). RUTF is an essential component of nutrition support for malnourished people with or without HIV. Information about the acceptability of RUTF among children and adults living with HIV is critical to procurement and planning for nutrition interventions for these populations in Vietnam.

To respond to this need, in 2011 NIN and IRD, in collaboration with the Food and Nutrition Technical Assistance III Project (FANTA), conducted a study to determine whether Plumpy'Nut and HEBI were acceptable to children and adults living with HIV and whether RUTF could have an impact on their nutritional status. The main objective of the study was to inform national nutrition policymakers and programmers. Data were compiled on three sets of outcomes—acceptability (measured as adherence to the take-home regimen), organoleptic properties, and nutritional status—in children and adults separately.

- *Acceptability* was assessed by measuring adherence to a take-home regimen of each product. If a child or adult consumed 50 percent or more of the intended dose of RUTF over the 2-week period, the product was considered acceptable. Children and adults were also asked which of the two products they preferred.
- *Six organoleptic properties* (color, smell, taste, texture, ease of swallowing, and difficulty of eating) were evaluated for both products by children and adults.
- *Nutritional status* was assessed by weighing and measuring MUAC (at baseline and weekly thereafter) and height (at baseline and endline for children and at baseline only for adults) to assess changes in weight and MUAC among adults and weight-for-age z-score (WAZ), height-for-age z-score (HAZ), BMI-for-age z-score (BMIZ), and MUAC among children. Changes in these anthropometric measurements were also compared between the two intervention groups and a comparison group.

5 Study Design

NIN provided ethical approval for the RUTF acceptability study. The study focused on adherence to a prescribed regimen of Plumpy'Nut and HEBI, the organoleptic properties of both products, and nutrition outcomes. Because adherence and preference may differ between children and adults, two parallel studies were conducted simultaneously, one with children with HIV attending the HIV outpatient clinic (OPC) of the National Pediatric Hospital in Hanoi and one with underweight adults with HIV attending the OPC of the Hospital for Tropical Diseases in Ho Chi Minh City. Each study was a randomized crossover trial in which participants were randomly assigned to the order in which they would receive the two RUTFs. In addition, for each study (in children and adults), a third group of participants (the control group) was randomly assigned to receive no RUTF. These participants' anthropometric and morbidity status were assessed at baseline and endline to provide a comparison for participants who received RUTF. Each 2-week treatment arm included a daily RUTF intervention of 500 kcal/day for children and 1,000 kcal/day for adults. After the initial 2-week RUTF treatment, the subjects were crossed over to receive the other RUTF intervention for 2 weeks. The study was non-blinded because the local RUTF was in a bar form and the imported RUTF was in a paste form.

To calculate the necessary sample size for the study, a difference of 20 percentage points in adherence (that is, a difference of 20 percentage points in the proportion of subjects who consumed at least 50 percent of both RUTFs) was regarded as important to be able to detect. Table 4 shows the sample sizes required to detect a 20 percentage point difference using a two-sided chi-square test with α set at 0.05 and 80 percent power. Note that as the proportion of subjects who consume at least half of the RUTF regimen approaches 50 percent, a larger sample size is required to detect the same percentage point difference. Given that the sample size to detect a difference of 20 percentage points ranges from 49 to 93, a sample size of 80 was selected to balance statistical rigor with cost and feasibility.

Table 4. Calculation of sample size

Percentage of subjects who ate > 50% of one RUTF	Percentage of subjects who ate > 50% of the other RUTF	Difference in percentage points in > 50% intake of the two RUTFs	Sample size
50	70	20	93
50	30	20	93
75	55	20	89
75	95	20	49

In each study, 80 HIV-positive participants were randomly assigned to the order in which they would receive each of the two RUTFs (HEBI first or Plumpy'Nut first). For each comparison group, 40 HIV-positive participants were selected.

A total of 204 children with HIV attending the OPC of the National Pediatric Hospital in Hanoi were assessed for eligibility in the children's study. To be eligible, the children had to be confirmed HIV positive, between the ages of 3 and 7 years at the time of enrollment, and living in an area accessible to home-based care teams, as well as to have WHZ < 0 at the time of enrollment. Initially, the

anthropometric enrollment criterion for children was WHZ < −2, but this was revised upward after the first 54 children were screened. Only one was found to have WHZ < −2, and four had WHZ < −1.

Adult patients in the OPC at the Hospital for Tropical Diseases in Ho Chi Minh City were initially told about the study during their checkups. To be eligible, the adults had to be confirmed HIV positive, more than 18 years old at the time of enrollment, and living in an area accessible to home-based care teams, as well as to have BMI < 20.0. Of the 2,572 patients screened, those who met the inclusion criteria had the study explained to them and, if they gave informed written consent, were invited to participate.

Table 5 lists the exclusion criteria for participation in each of the studies.

Table 5. Exclusion criteria

Children	Adults
• Presence of edema • Hepatic problems • Severe cerebral palsy, obvious dysmorphic features, or general mental health problems (e.g., Down syndrome) • Specific allergies to or intolerance of the ingredients in either RUTF • Any uncontrolled or untreatable systemic opportunistic infection at the time of study entry or irreversible oral problem that prevented adequate swallowing • Adverse reaction to or refusal to consume a test dose of either RUTF provided under clinical supervision during enrollment • Severe health conditions that prevent measurement of weight or height	• Presence of edema • Hepatic problems • Severe cerebral palsy, obvious dysmorphic features or general mental health problems (e.g., Down syndrome) • Specific allergies to or intolerance of the ingredients in either RUTF • Any uncontrolled or untreatable systemic opportunistic infection at the time of study entry or irreversible oral problem that prevented adequate swallowing • An adverse reaction to a test dose of either RUTF provided under clinical supervision before enrollment • Severe health conditions that prevent measurement of weight or height

6 Data Collection and Analysis

At the time of enrollment in the study, the medical team (composed of a doctor and several nurses) in each hospital collected baseline weight, height, MUAC, and appetite data from potential study participants. In addition, they took medical histories and collected information about current illnesses and symptoms. Caregivers were asked to return to the hospital every week with their children who were participating in the study for monitoring and follow-up data collection. Adult study participants were asked to return to the hospital every week for the same purpose. The doctors and nurses measured weight and MUAC weekly at the OPCs during the participants' follow-up visits. Height was measured at enrollment only for adults and at enrollment and at the end of the study (4 weeks later) for children. The medical teams did not measure morbidity among study participants systematically because the sample size was too small to allow for meaningful analysis. However, the assessment team screened for possible side effects of the RUTF by asking each medical team to complete a form every day to record any symptoms experienced (rash, vomiting, diarrhea). Morbidity was also checked weekly through a recall questionnaire administered during the follow-up visit at the OPC (Annex 2).

6.1 Provision of RUTF

Participants were given RUTF weekly. Children received one bar of HEBI (500 kcal) or one sachet of Plumpy'Nut (500 kcal) per day, and adults received two bars of HEBI (1,000 kcal) or two sachets of Plumpy'Nut (1,000 kcal) per day. Each bar or sachet was labeled with a day of the week. Each adult participant and caregiver of a child participant was asked to use the RUTF on the day marked and to take any unused or unopened bars or sachets to the OPC on the next weekly follow-up visit. Intake monitoring started at home, with participants or caregivers closely monitoring their own or their children's daily consumption of HEBI or Plumpy'Nut. For this monitoring, they received all the necessary intake forms to complete. Caregivers (of the children) and patients (adults) recorded RUTF intake and collected information on the quantity of RUTF given, eaten, and wasted and/or spilled. These data were then totaled over the 2-week period to calculate the percent of the prescribed dose consumed during the 2-week period. At the end of every 2 weeks, nurses also asked participants (or caregiver, if child participants did not understand well) to rate the organoleptic properties of the RUTFs. The possible ratings on each of the organoleptic properties (color, smell, taste, texture, ease of swallowing, difficulty of eating) were "dislike," "so-so," and "like."

6.2 Data Analysis

Data were analyzed using SAS© statistical software, version 9.2. The data from the child and adult studies were analyzed separately. For study participant baseline characteristics, measures of central tendency (for continuous variables) and spread (for categorical variables) were calculated separately for intervention and comparison groups, and those were compared to each other using a Student's t-test or chi-square test as applicable. For children, WAZ, HAZ, and BMIZ were calculated using WHO growth standards and references. Anthropometric changes after consumption of each of the two RUTF were calculated and compared using a paired t-test. In addition, anthropometric changes during the whole study period for the intervention group were compared to changes in the comparison group using a two sample t-test.

7 Findings

This section presents the findings of the study for both children and adults.

7.1 Children

The baseline characteristics of the children who participated in the RUTF acceptability trial were not statistically different from those of the children in the comparison group (Table 6). A little more than one-half of the children in each group were moderately malnourished, and most were on ART.

Table 6. Child participants' baseline characteristics

Characteristic	Intervention group		Comparison group		P-value for difference (χ^2 or t-test)
	Mean ± SD or %	n	Mean ± SD or %	n	
Age (years)	6.7 ± 2.1	79	6.2 ± 1.8	40	0.20
Sex (% males)	56	44/79	44	18/41	0.22
CD4 count (cell x 10^6/L)	667.1 ± 333.1	67	678.6 ± 788.3	30	0.92
On ARVs	84	46/55	91	29/32	0.36
Baseline weight (kg)	16.8 ± 4.0	78	15.9 ± 3.8	41	0.25
Baseline WAZ	–2.14 ± 0.93	74	–2.11 ± 1.03	39	0.89
< –2 WAZ	53	39/74	56	22/39	0.71
Baseline height (cm)	107.2 ± 16.3	78	103.9 ± 12.1	41	0.26
Baseline HAZ	–2.39 ± 2.00	75	–2.42 ± 1.31	40	0.93
< –2 HAZ	61	46/75	60	24/40	0.89
Baseline BMIZ	–0.74 ± 2.00	75	–0.70 ± 1.17	40	0.90
< –2 BMIZ	13	10/75	13	5/40	0.90
Baseline MUAC (mm)	149.9 ± 12.1	78	148.5 ± 11.9	41	0.55

7.1.1 Adherence and Organoleptic Assessment

On average, the children consumed 69 percent of the HEBI and 65 percent of the Plumpy'Nut that they were provided in each 2-week period (Table 7). Both these levels were higher than the 50 percent defined as acceptable. The percent consumption of HEBI did not differ statistically from that of Plumpy'Nut (p=0.13). During the second week of the take-home regimen, children consumed an average of 4.8 servings of HEBI and 4.4 servings of Plumpy'Nut (p=0.066).

Table 7. Child participants' consumption of the two RUTFs

Variable	HEBI	n	Plumpy'Nut	n	Paired t-test p-value
Servings consumed during first week of take-home regimen[a]	4.9 ± 1.6	80	4.6 ± 1.7	81	0.35
Servings consumed during second week of take-home regimen[a]	4.8 ± 1.5	79	4.4 ± 1.9	81	0.066
Difference between the 2 weeks (paired t-test p-value)	0.62		0.089		
Percent of total take-home ration consumed during first and second weeks	69%	78	65%	81	0.13

[a] Values presented are mean ± SD.

No statistically significant differences were found between the children's assessments of the organoleptic properties of HEBI and Plumpy'Nut (Table 8). The most frequent rating for each organoleptic property (color, smell, taste, texture, ease of swallowing, and difficulty of eating) on a scale of 1 to 3 was 2 ("so-so"). Those who indicated an overall RUTF preference tended to prefer HEBI (65 percent) to Plumpy'Nut (35 percent) (p=0.058), but 49 percent of the children did not indicate a preference for either product.

Table 8. Child participants' assessment of the organoleptic properties of the two RUTFs

Organoleptic property	RUTF	Rating[a]										Mean rating ± SD	P value for Wilcoxon signed rank test
		1		1.5		2		2.5		3			
		%	N	%	n	%	n	%	n	%	n		
Taste	HEBI	8%	6	4%	3	77%	61	5%	4	6%	5	1.99 ± 0.40	0.46
	Plumpy'Nut	9%	7	12%	9	72%	56	0%	0	8%	6	1.93 ± 0.44	
Color	HEBI	4%	3	3%	2	90%	71	3%	2	1%	1	1.97 ± 0.25	0.99
	Plumpy'Nut	4%	3	5%	4	86%	67	3%	2	3%	2	1.97 ± 0.29	
Smell	HEBI	8%	6	4%	3	78%	62	4%	3	6%	5	1.99 ± 0.40	0.70
	Plumpy'Nut	8%	6	10%	8	74%	58	0%	0	8%	6	1.95 ± 0.42	
Texture	HEBI	5%	4	5%	4	82%	65	4%	3	4%	3	1.98 ± 0.33	0.89
	Plumpy'Nut	5%	4	8%	6	82%	63	0%	0	5%	4	1.96 ± 0.35	
Ease of swallowing	HEBI	5%	4	3%	2	86%	68	3%	2	4%	3	1.99 ± 0.32	0.77
	Plumpy'Nut	8%	6	10%	8	74%	58	0%	0	8%	6	1.95 ± 0.42	
Difficulty eating	HEBI	13%	10	8%	6	53%	41	8%	6	19%	15	2.06 ± 0.60	0.13
	Plumpy'Nut	27%	21	6%	5	43%	33	6%	5	17%	13	1.90 ± 0.69	

[a] A rating of 1 is equivalent to the response "dislike," 2 to the response "so-so," and 3 to the response "like." The ratings in this table are the means of the ratings on 2 consecutive weeks.

7.1.2 Anthropometric Changes

After 4 weeks of consuming the RUTFs, children did not experience a statistically significant difference in anthropometry between the 2 weeks when they consumed HEBI and the 2 weeks when they consumed Plumpy'Nut (Table 9). This is not surprising given that the study was not powered to detect differences between the two RUTFs in terms of their effects on anthropometric measures.

Table 9. Child participants' anthropometric changes after consuming each of the two RUTFs

Anthropometric change at the end of 2 weeks of consumption[a]	HEBI (2 weeks)	n	Plumpy'Nut (2 weeks)	n	Paired t-test p-value
Percent weight change	2.7%	74	1.72%	76	0.19
WAZ	0.18 ± 0.36	70	0.14 ± 0.16	72	0.33
BMIZ[b]	0.20 ± 0.47	71	0.14 ± 0.25	71	0.34
MUAC (mm)	0.22 ± 3.95	73	0.08 ± 5.92	76	0.91

[a] Values presented are mean ± SD.
[b] Height was measured only at baseline and endline. For the BMIZ calculation at midterm, the mean of the baseline and endline heights was used.

On the other hand, the children who consumed the two RUTFs over a 4-week period had significantly greater gains in WAZ (0.32 vs. 0.14, p=0.014) and BMIZ (0.35 vs. 0.16, p=0.036) than the children who did not receive any RUTF, as well as a significantly greater percent weight gain (4.4 percent vs. 2.0 percent, p=0.035) (Table 10).

Table 10. Child participants' anthropometric changes over the duration of the study

Anthropometric change at the end of the 4-week trial[a]	Both RUTFs (4 weeks)	n	Comparison (4 weeks)	n	T-test p-value
Percent weight change	4.4%	76	2.0%	37	0.035
WAZ	0.32 ± 0.37	72	0.14 ± 0.25	36	0.014
HAZ	0.09 ± 0.30	73	0.04 ± 0.08	37	0.28
BMIZ	0.35 ± 0.50	73	0.16 ± 0.31	37	0.036
MUAC (mm)	0.42 ± 6.70	75	0.35 ± 1.09	37	0.93

[a] Values presented are mean ± SD.

7.2 Adults

The baseline characteristics of the adults in the intervention group also did not differ significantly from those in the comparison group (Table 11). Almost two-thirds of the participants in each group were male, and all adult participants were on ART. Most of the adult participants had BMI < 18.5, and a little more than one-half had MUAC < 230 mm.

Table 11. Adult participants' baseline characteristics

Characteristic	Intervention group		Comparison group		P value for difference (χ^2 or t-test)
	Mean ± SD or %	n	Mean ± SD or %	n	
Age (years)	34.2 ± 6.1	73	33.9 ± 8.5	38	0.82
Males	59	43/73	63	24/38	0.66
CD4 count	208.6 ± 175.3	75	235.3 ± 162.3	38	0.43
On ART	100	81/81	100	43/43	0.99
Baseline weight (kg)	44.5 ± 4.4	73	45.0 ± 3.4	38	0.51
Baseline height (cm)	161.2 ± 6.9	73	160.6 ± 6.4	38	0.64
Baseline BMI	17.1 ± 1.2	73	17.5 ± 1.2	38	0.14
Baseline BMI < 18.5	89	65/73	82	31/38	0.28
Baseline MUAC (mm)	224.7 ± 21.7	73	226.6 ± 20.9	37	0.66
Baseline MUAC < 230 mm	55	40/73	51	19/37	0.73

7.2.1 Adherence and Organoleptic Assessment

On average, the participants in the adult study consumed 91 percent of the dose of HEBI that they were provided and 81 percent of the dose of Plumpy'Nut. Table 12 shows that the difference in consumption between the two products was marginally statistically significant (p=0.059). The amount of each RUTF consumed exceeded the 50 percent defined by the researchers as acceptable. That said, an interesting trend was noted in the consumption of the RUTF from the first week of the regimen to the second week. While the mean number of servings of HEBI consumed tended to increase (non-significantly) from week 1 (12.3 servings) to week 2 (12.7) (p=0.88), the mean number of servings of Plumpy'Nut consumed decreased significantly from week 1 (11.6 servings) to week 2 (11.0 servings) (p=0.019). The difference between the number of servings of HEBI and the number of servings of Plumpy'Nut consumed in week 1 showed a trend toward significance (p=0.095), but the difference between the number of servings of the two RUTFs consumed in week 2 became more significant (p=0.031).

Table 12. Adult participants' consumption of the two RUTFs

Variable[a]	HEBI	n	Plumpy'Nut	n	Paired t-test p-value
Servings consumed during first week of take-home regimen	12.3 ± 3.0	64	11.6 ± 3.7	61	0.095
Servings consumed during second week of take-home regimen	12.7 ± 2.5	57	11.0 ± 4.4	54	0.031
Difference between the 2 weeks (paired t-test p-value)	0.88		0.019		
Percent of total take-home ration (both weeks) consumed	91%	56	81%	52	0.059

[a] Values presented are mean ± SD.

Most of the adults' ratings of the organoleptic properties of each RUTF were similar across RUTFs (Table 13). The only statistically significant difference was a more frequent rating of the texture of HEBI as "liked" and a more frequent rating of the texture of Plumpy'Nut as "disliked" ($p=0.0067$). The taste of HEBI was more frequently "liked" and less frequently "disliked" than the taste of Plumpy'Nut, but this difference was only marginally significant ($p=0.086$). Most adults expressed an overall preference for HEBI (79 percent) over Plumpy'Nut (21 percent) ($p=<0.0001$).

Table 13. Adult participants' assessment of the organoleptic properties of the two RUTFs

Organoleptic property	RUTF	Rating[a]										Mean score ± SD	P value for Wilcoxon signed rank test
		1		1.5		2		2.5		3			
		%	n	%	n	%	n	%	n	%	n		
Taste	HEBI	13%	8	0%	0	54%	33	2%	1	31%	19	2.18 ± 0.64	**0.086**
	Plumpy'Nut	32%	21	2%	1	42%	28	3%	2	21%	14	1.93 ± 0.75	
Color	HEBI	3%	2	0%	0	58%	34	0%	0	39%	23	2.36 ± 0.55	0.30
	Plumpy'Nut	11%	7	0%	0	52%	34	5%	3	33%	22	2.26 ± 0.63	
Smell	HEBI	10%	6	0%	0	53%	32	5%	3	32%	19	2.27 ± 0.62	0.86
	Plumpy'Nut	18%	12	2%	1	45%	30	2%	1	33%	22	2.18 ± 0.72	
Texture	HEBI	16%	10	3%	2	34%	21	3%	2	43%	26	2.25 ± 0.75	**0.0067**
	Plumpy'Nut	43%	28	0%	0	29%	19	2%	1	26%	17	1.87 ± 0.84	
Ease of swallowing	HEBI	31%	19	2%	1	20%	12	2%	1	46%	28	2.16 ± 0.87	0.70
	Plumpy'Nut	39%	26	5%	3	17%	11	2%	1	38%	25	2.01 ± 0.92	
Difficulty of eating	HEBI	47%	28	2%	1	25%	15	0%	0	25%	15	1.83 ± 0.92	0.93
	Plumpy'Nut	37%	24	2%	1	43%	28	0%	0	18%	12	1.78 ± 0.73	

[a] A rating of 1 is equivalent to the response "dislike," 2 to the response "so-so," and 3 to the response "like." The ratings in this table are the means of the ratings on 2 consecutive weeks.

7.2.2 Anthropometric changes

Like the children, the adults who consumed HEBI showed no statistically significant differences in anthropometry from those who consumed Plumpy'Nut after 2 weeks of consumption of each RUTF (Table 14).

Table 14. Adult participants' anthropometric changes after consuming the RUTFs

Change (mean ± SD) at the end of 2 weeks of consumption[a]	HEBI (2 weeks)	n	Plumpy'Nut (2 weeks)	n	Paired t-test p-value
Percent weight change	0.9%	57	1.4%	58	0.61
BMI (kg/m^2)	0.17 ± 0.41	57	0.24 ± 0.59	58	0.65
MUAC (mm)	0.40 ± 13.17	52	–2.30 ± 19.2	53	0.55

[a] Values presented are mean ± SD or percent.

There were statistically significant differences, however, in percent weight gain and BMI gain among the adults who consumed the two RUTFs in sequence during the 4 weeks of the study and those who did not consume any RUTF (Table 15). Those who consumed the RUTF gained an average of 2.3 percent of their initial weight during the 4 weeks, while the comparison group gained an average of 0.5 percent (p=0.017). This weight gain translated into a significant difference in BMI change but not MUAC change.

Table 15. Adult participants' anthropometric changes over the duration of the study

Change (mean ± SD) at the end of the 4-week trial[a]	Both RUTFs (4 weeks)	n	Comparison (4 weeks)	n	T-test p-value
Percent weight change	2.3%	59	0.5%	31	0.017
BMI (kg/m^2)	0.40 ± 0.68	59	0.10 ± 0.27	31	0.0048
MUAC (mm)	–1.89 ± 19.17	54	0.41 ± 3.23	29	0.39

[a] Values presented are mean ± SD or percent.

8 Discussion

Both HIV-positive children and HIV-positive adults who participated in the study consumed more than 50 percent of 2-week take-home regimens of both HEBI and Plumpy'Nut, showing that both RUTFs were considered acceptable. The adults showed a clearer preference than the children for HEBI and consumed more of it than the Plumpy'Nut. However, when asked to rate the products on specific organoleptic properties, the adults tended to rate them similarly, except for a significantly greater preference for HEBI's texture. The children's RUTF preference was less clear. They consumed a similar percentage of the take-home regimens of both RUTFs (69 percent of the HEBI and 65 percent of the Plumpy'Nut), and only one-half of those who participated in the trial expressed a preference for one product over the other. Of those who did indicate a preference, two-thirds preferred HEBI. The children rated both products' organoleptic properties similarly.

The study did not, and was not powered to, find a difference in the effect of the two products on anthropometric status. It did, however, show that a 2-week regimen of one RUTF followed by a 2-week regimen of the other RUTF had a statistically significant effect on weight and BMI gain in both children and adults.

The study had several limitations. First, because of the different packaging of the products, the participants were not blinded to the treatment they received during each 2-week period. In addition, the Plumpy'Nut was labeled in French and English, as per UNICEF requirements, whereas the local RUTF was labeled in English and Vietnamese. This may have introduced a bias, positive or negative, in participants' comparative assessment of the products.

A second limitation of the children's study is that not all of the children were on ART, and their anthropometric response to RUTF and assessment of the RUTFs' organoleptic properties may have differed significantly based on whether or not they were receiving treatment. However, as the study had a crossover design and there were no baseline differences between the two crossover groups, all subjects consumed both products, minimizing the potential bias in comparing results across products.

9 Recommendations

Both HEBI and Plumpy'Nut were accepted by the sample of children and adults living with HIV in Vietnam participating in this study. Adults indicated a strong preference for HEBI over Plumpy'Nut, and children tended to prefer HEBI to Plumpy'Nut. However, before HEBI can be used in a programmatic setting, the product must complete the lengthy certification process by UNICEF, and production needs to ramp up to cover the demand. Because Plumpy'Nut was shown to be acceptable among the sample of children and adults included in this study, it would be reasonable to consider using it in the interim, provided that patients and medical providers receive appropriate information and education on the intended purpose and appropriate use of the product.

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Annex 1. Questionnaires for Participants

Questionnaire for Children and Caregivers Interviewed at the Hospital at the End of Weeks 1 and 2

Date: .... /.... /2010 Name of interviewer: _____

Week: 1 / 2 Hospital reg. # _____

Patient name: _____ Age: _____ Gender: M / F

Questions

Can you describe the food you have been eating this week?

a. What about the color?	Dislike		So-so		Like	
b. What about the smell?	Dislike		So-so		Like	
c. What about the taste?	Dislike		So-so		Like	
d. What about the look (appetizing)?	Dislike		So-so		Like	
e. What about the texture?	Dislike		So-so		Like	
f. Was it difficult to swallow?	No		So-so		Yes	

Questionnaire for Children and Caregivers Interviewed at the Hospital at the End of Weeks 3 and 4

Date: .... /.... /2010 Name interviewer: _____

Week: 3 / 4 Hospital reg. # _____

Patient name: _____ Age: _____ Gender: M / F

Questions for the child

Can you describe the food you have been eating this week?

a. What about the color? Dislike  So-So  Like 

b. What about the smell? Dislike  So-So  Like 

c. What about the taste? Dislike  So-So  Like 

d. What about the look (appetizing)? Dislike  So-so  Like 

e. What about the texture? Dislike  So-so  Like 

f. Was it difficult to swallow? No  So-so  Yes 

Was the food you have been eating this week different from the food you ate the first weeks?

Yes / No

Was it: Worse  Equal  Better 

If it was different, what was different? _____

Questions for the caregiver

What are your perceptions about the two products? Are they familiar to you? Are they easy to use?

Which product do you prefer? Why?

Questionnaire for Adults Interviewed at the Hospital at the End of Weeks 1 and 2

Date: .... /.... /2010 Name of interviewer: _____

Week: 1 / 2 Hospital reg. # _____

Patient name: _____ Age: _____ Gender: M / F

Questions

Can you tell me whether the food you have been eating this week:

a. Had a nice color? Dislike  So-so  Like 

b. Had a nice smell? Dislike  So-so  Like 

c. Had a nice taste? Dislike  So-so  Like 

d. Looked good (appetizing)? Dislike  So-so  Like 

e. Was it difficult to swallow? No  So-so  Yes 

Questionnaire for Adults Interviewed at the Hospital at the End of Weeks 3 and 4

Date: .... /.... /2010 Name interviewer: _____

Week: 3 / 4 Hospital reg. # _____

Patient name: _____ Age: _____ Gender: M / F

Questions

Can you tell me whether the food you have been eating this week:

a. Had a nice color? Dislike  So-so  Like 

b. Had a nice smell? Dislike  So-so  Like 

c. Had a nice taste? Dislike  So-so  Like 

d. Looked good (appetizing)? Dislike  So-so  Like 

e. Was it difficult to swallow? No  So-so  Like 

Was the food you have been eating this week different from the food you eat the first weeks?

Yes/No

Was it: Worse  Equal  Better 

If it was different, what was different? _____

What are your perceptions about the two products? Are they familiar to you? Are they easy to you?

Which product do you prefer? Why?

Annex 2. Intake Monitoring and Morbidity Follow-up Form

Hospital _____

Name of interviewer _____

Patient name _____

Hospital registration no. _____

Duration: From _____(date) to _____ (date)

N		Sunday	Monday	Wednesday	Thursday	Friday	Saturday	Notes
1. Weight								Once/week
2. MUAC								Once/week
Intake								
3. Quantity given								
4. Quantity eaten								
5. Extent of waste and/or spillage (0, 0.25, 0.50, 0.75, or 1)								
Eating pattern								
6. Refused food (1 = Yes, 2 = No)								
7. Needed support (1 = Yes, 2 = No)								
8. Reluctant to eat (1 = Yes, 2 = No)								
9. Duration of meal (minutes)								
Morbidity								
10. Nausea (1 = Yes, 2 = No)								
11. Vomiting (1 = Yes, 2 = No)								
12. If vomiting, how many times?								
13. Rash (1 = Yes, 2 = No)								
14. Diarrhea? (1 = Yes, 2 = No)								