# HY-09 Feeding the sick and the starving: refeeding, famine medicine and home-made therapeutic food

HEALING after the FALL, research library, HY-09

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

## How to read this report

This report covers why feeding the starving can kill them, the famine relief record, the WHO protocol and its home-made foods, and how to feed the acutely ill. Most evidence concerns children aged 6 months to 5 years, because that is where relief agencies counted. Adults are covered where the record allows.

The related reports HY-08, MA-07, NU-01, NU-02 and MA-06 were not yet in the library when this was written. This report builds on IN-01, HY-03, FO-01, FO-04, FO-07 and FO-11.

Severe acute malnutrition (SAM) means severe wasting or pitting oedema of both feet. F-75 and F-100 are WHO therapeutic milks with 75 and 100 kcal per 100 ml. RUTF is ready-to-use therapeutic food, a peanut paste.

## Findings by section

### 1. What starvation does, and why feeding can kill

**What the record shows.** A starving body adapts by slowing down. WHO calls this "reductive adaptation" (WHO 2003). Basal metabolic rate fell by about 25% in the Minnesota volunteers and was still about 10% low after three months of refeeding (Schwarcz 2021, Wikipedia 2026a). The heart shrinks, the gut lining thins, the liver loses its capacity to make glucose, and the kidneys lose the ability to get rid of a salt load. The body loses potassium, magnesium, phosphate and zinc from inside its cells while it holds too much sodium. WHO states plainly that all severely malnourished children have excess body sodium, even when blood sodium reads low, and that potassium and magnesium deficits take at least two weeks to correct (WHO 2003). Signs of dehydration are unreliable in the wasted child, because sunken eyes and a dry mouth come from wasting itself (WHO 1999).

**What modern science infers.** When food arrives, especially carbohydrate, insulin rises. Insulin drives glucose, phosphate, potassium and magnesium into cells. Blood levels of these minerals can then crash within a day or two. Low phosphate starves muscle, including the heart and the breathing muscles, of the energy it needs. Thiamine (vitamin B1) is used up by the sudden glucose load, and the result can be Wernicke encephalopathy or heart failure. Sodium and water are retained, and a shrunken heart cannot carry the extra volume (Mehanna 2008). ACF's guidelines, written by Michael Golden and Yvonne Grellety, add that phosphorus is the limiting nutrient in F-75, because all of it comes from the milk powder. They warn that "alternative recipes that have reduced amounts of dried skimmed milk are potentially dangerous unless additional phosphorus is added" (ACF about 2011).

**How common it is.** The true incidence of refeeding syndrome is unknown, because there is no agreed definition. In one intensive care cohort, 34% of patients developed low phosphate soon after feeding began. Among 10,197 hospital

inpatients, 0.43% developed severe low phosphate. When intravenous feeding was given without phosphate, every patient developed low phosphate. With phosphate in the solution the figure fell to 18% (Mehanna 2008). There are no randomised trials of refeeding regimens in famine adults. Everything below rests on physiology, clinical series and consensus.

**The limits on feeding.** Two families of rules exist, and they differ sharply. They should not be blended without understanding why.

- **The hospital rule for adults (NICE 2006, reproduced by Mehanna 2008 and NHS Highland 2025).** High risk means any one of the following: BMI under 16, unintentional weight loss over 15% in 3 to 6 months, little or no food for more than 10 days, or low potassium, phosphate or magnesium before feeding. High risk also means any two of these: BMI under 18.5, weight loss over 10%, little or no food for more than 5 days, or a history of alcohol misuse or of drugs such as insulin, chemotherapy, antacids or diuretics. For high-risk patients, start at no more than 0.042 MJ/kg/day and reach full needs over 4 to 7 days. For the very wasted (BMI 14 or less, or almost no food for two weeks or more), start at no more than 0.021 MJ/kg/day (Mehanna 2008). By my conversion, 0.042 MJ is 10 kcal and 0.021 MJ is 5 kcal [VERIFY]. A 40 kg adult would therefore start at 400 kcal a day, or 200 kcal if very wasted.
- **The famine rule (WHO 1999 for adults, WHO 2003 for children).** WHO's adult table starts adults aged 19 to 75 at 40 kcal/kg/day of F-75, given as 2.2 ml/kg every hour. Ages 15 to 18 start at 50 kcal/kg, ages 11 to 14 at 60, ages 7 to 10 at 75, and those over 75 at 35. Individual needs may differ by up to 30% (WHO 1999). Children start at 100 kcal/kg/day and must never go above it in the first phase (WHO 2003).

The two rules differ by a factor of four for the same adult. The likely reason is that the famine rule builds the protection into the food rather than into the blood tests. F-75 is low in protein (0.9 g per 100 ml) and low in sodium, carries added potassium and magnesium, is given in small feeds every two hours, and comes with vitamins and close watch on breathing and pulse. The NICE rule assumes ordinary food or standard feeds, with a laboratory to replace minerals intravenously [VERIFY: this is my inference, not stated by either source]. After the Fall, a village has neither the laboratory nor, usually, the F-75. The safe course is the lower NICE start for any adult who is very wasted, rising every day or two over a week, with the WHO watch for breathing, pulse and oedema.

**Thiamine.** NICE advises thiamine 200 to 300 mg daily by mouth, vitamin B compound strong 1 or 2 tablets three times a day and a balanced multivitamin and trace element supplement once daily, started immediately before feeding and continued for the first 10 days (NICE 2006 as quoted by NHS guidance found in search, not read in the original). NHS Highland gives thiamine 200 mg daily by mouth for 7 to 10 days, started at least 30 minutes before feeding (NHS Highland 2025). The two sources agree on 200 mg as the floor and differ on whether to go to 300 mg. WHO 1999's vitamin mix gives only 0.7 mg thiamine per litre of feed. That is a nutritional dose, not a treatment dose.

**Electrolyte replacement where there is a laboratory.** Mehanna (2008) gives oral phosphate 0.3 to 0.6 mmol/kg/day, and intravenous phosphate below 0.6 mmol/l. NHS Highland (2025) uses tablets at 0.32 to 0.5 mmol/l and infusion below 0.32, so the cut-offs differ slightly. Both measure electrolytes daily for 5 to 7 days. Without a laboratory, the village must rely on food: potassium and magnesium in the feed, milk for phosphate, and a slow start.

### 2. The historical record: the camps of 1945, Warsaw 1942, Minnesota 1944 to 1945

**Older warnings.** Hemstreet and Weisz (2024) trace deaths after feeding from Josephus on the siege of Jerusalem to Tottori Castle in 1581, where more than half of those fed after the surrender are said to have died. They caution that such deaths are hard to attribute unequivocally to refeeding.

**Warsaw ghetto, February to August 1942.** Under Izrael Milejkowski, a team of about two dozen Jewish physicians in two hospitals studied "hunger disease" while dying of it themselves. Sources give 22 or 28 doctors. They

included Julian Fliederbaum, Anna Braude-Heller and Emil Apfelbaum, who edited the 1946 edition (Hektoen International 2022, Wikipedia 2026b). The official ration was about 180 kcal a day. Pure hunger disease was defined as an intake under 800 kcal with no other disease. They studied children aged 6 to 12 and adults aged 20 to 40. Adults weighed 30 to 40 kg, about half their former weight. One woman 152 cm tall weighed 24 kg. Of about 3,600 autopsies in the ghetto, around 500 were of starvation alone (Hektoen International 2022). Hemstreet and Weisz (2024) report blood glucose falling to 32 mg% after a sugar load, the failure of the starved body to handle sugar. They found intestinal changes in only 27.2% of autopsies, which argues against the belief that the gut simply wastes away. The doctors found that metabolic changes reversed quickly and cardiac changes slowly, and they advised slow refeeding. Deportations to Treblinka began on 22 July 1942 and ended the study. The manuscript was smuggled out and published in 1946. Myron Winick edited the English translation by Martha Osnos (Winick 1979, not read). In it, the advice is "Refeed these people slowly!" (Hemstreet 2024, quoting Winick).

**Bergen-Belsen, from 15 April 1945.** British troops found about 60,000 prisoners. Hemstreet and Weisz (2024) report that an estimated quarter died within days, and that Lazovik put the figure above 30%. Somerville College's account of Dame Janet Vaughan's work gives 13,994 deaths after liberation. It says the army's tinned "bully beef" killed an estimated 2,000 people whose guts could not handle it (Somerville College 2020, search summary). Vaughan's team, sent by the Medical Research Council, tried protein hydrolysates by mouth, nasal tube and vein. Prisoners refused them. What worked was skimmed milk and then the "Bengal famine mixture", given in small oral amounts. The sources disagree on the mixture's ingredients. Hemstreet and Weisz (2024) list flour, sugar, salt, yeast and shark-liver oil. An account of Arnold Peter Meiklejohn lists dried milk, flour, sugar and molasses, and reports that Meiklejohn thought it halved the death rate (Belsen.co.uk undated). Europeans found it too sweet. Collis reported deaths falling from 300 to 60 a day (Hemstreet 2024). Mollison found weight losses of 29% to 56%, and tuberculosis in 40% of the people he examined (Hemstreet 2024).

**Other series** (via Hemstreet and Weisz 2024, originals not read). Burger recorded pulses averaging 40 a minute in western Holland in 1945. Walters fed Indian prisoners of war 3,800 rising to 5,300 kcal and saw beriberi in 20%. Schnitker described 24 Japanese prisoners of war in 1951, 12 with massive oedema, of whom 5 died.

**The Minnesota Starvation Experiment, 19 November 1944 to 20 December 1945.** Ancel Keys and colleagues starved 36 conscientious objectors to learn how to refeed Europe (Wikipedia 2026a). A 12-week control phase at about 3,200 kcal was followed by 24 weeks of semi-starvation at about 1,570 kcal. Some sources give 1,600 to 1,800 kcal. The diet was potatoes, turnips, bread and macaroni. The men lost about 25% of their weight and developed oedema, depression and obsession with food. One, Sam Legg, cut off three fingers with an axe. Rehabilitation lasted 12 weeks in four groups at different calorie levels, followed by 8 weeks of free eating. The lower-calorie groups did not recover, and every group's allowance was raised by 800 kcal. The researchers concluded that about 4,000 kcal a day was needed to rebuild strength (Schwarcz 2021, American RadioWorks undated). Extra vitamins and protein made no difference that could be measured (Schwarcz 2021). Once food was free, some men ate over 5,000 kcal a day and still felt hungry (Schwarcz 2021). Fat came back before muscle. The full findings are in *The Biology of Human Starvation* (Keys 1950), 1,385 pages in two volumes, which was not read for this report.

**What the record teaches.** The two lessons look opposite but are not. The 1945 deaths came from feeding too fast, too rich, with the wrong food, in the first days. Minnesota showed that after the first weeks, recovery needs far more food than intuition suggests: around 4,000 kcal a day for a young man, or 150 to 220 kcal/kg/day for a child (WHO 2003). The modern protocol is both lessons in sequence. Go slowly for one week, then feed very generously for weeks.

### 3. Famine relief: Biafra, Ethiopia, Somalia and Sudan, and the new foods

**Biafra, 1967 to 1970.** The blockade of secessionist Biafra caused somewhere between one and three million deaths (Wikipedia 2026c). Kwashiorkor spread when imported stockfish stopped. The Red Cross estimated 10,000 deaths a day in late 1968 (Wikipedia 2026c). Joint Church Aid and the ICRC flew relief into the airstrip at Uli at night. At its

peak the airlift fed about 1.5 million people a day and supplied a quarter to a third of their calories (Wikipedia 2026c). UNICEF developed K-Mix 2, a mix of calcium caseinate, dried skimmed milk and sugar, for Biafra (Wikipedia 2026d, secondary). The QUAC stick, which measures arm circumference against height, came out of the Nigerian crisis. Davis reported that the method "was simple enough to be performed by unskilled Nigerians under supervision" (Myatt 2006, quoting Davis).

**Ethiopia, 1984 to 1985.** More than a million people died (Wikipedia 2026e). At Korem in Wollo, deaths in the main camp rose from about 15 a month in January 1984 to 1,549 in September and an estimated 1,800 in October, according to a local official quoted by the Christian Science Monitor (Christian Science Monitor 1984). That is about 50 to 60 a day by my arithmetic [VERIFY]. Other accounts put the daily peak above 100 (Wikipedia 2026f). Of 206,000 people registered for rations around Korem, fewer than 40,000 were being fed (Christian Science Monitor 1984). A feeding programme mortality series for Wollo was not found.

**Somalia 1992 and the camps.** In the Baidoa displaced camps, crude mortality averaged 16.8 per 10,000 people per day over the 232 days before the survey (Moore 1993, abstract via search summary). That is more than 30 times the usual emergency threshold of 0.5 per 10,000 per day [VERIFY threshold]. An estimated 74% of children under five in the camps died in that period. The rate in Afgoi was 4.7 per 10,000 per day. Measles and diarrhoea were the main killers. The CDC's survey of the same towns attributes 28% of deaths to measles and 22% to diarrhoea (CDC 1992). Toole and Waldman found acute-phase death rates in refugee and displaced camps of the 1980s up to 60 times the expected rate, worst in Ethiopia in 1985 and Sudan in 1988. The causes were measles, diarrhoea, respiratory infection and malaria on top of malnutrition (THRIVING library, FO-11). At Gode in Ethiopia in 2000, the population swelled from 15,000 to 40,000 in six months. Diarrhoea caused 35% of deaths and measles 16% (an Ethiopian report found by search, primary source not identified) [VERIFY]. The brief's warning holds: famine kills mostly through infection. Starvation removes the defences, and crowding, dirty water and measles do the killing. Feeding alone will not stop a famine death rate. Water, latrines and measles vaccination are part of famine medicine (THRIVING library, FO-01).

**The feeding centre problem.** In the 1980s and 1990s the standard response was the therapeutic feeding centre, an inpatient unit for severe cases. Steve Collins argued in 2001 that these centres had low coverage, drew crowds and spread infection between patients, and required the mother to leave her family for about 30 days (Collins 2001, abstract and secondary summary).

**F-75 and F-100.** WHO's 1999 manual fixed the two-milk system: F-75 for stabilisation and F-100 for catch-up growth (WHO 1999). A secondary source credits Action contre la Faim with pioneering F-100 in 1994 (Wikipedia 2026d). The role of Michael Golden and André Briend in designing the formulas is widely stated but was not confirmed in a primary source [VERIFY]. The point of F-75 is in its numbers. It gives 75 kcal and only 0.9 g protein per 100 ml (5% of energy from protein), with low sodium and added potassium and magnesium. It is designed for a body that cannot yet handle protein or salt (WHO 2003).

**RUTF.** In 1999 Briend, Golden and colleagues reported in a Lancet letter a paste with the nutrient profile of F-100 that needed no water and resisted bacteria (Briend 1999, known through secondary summaries). The idea was simple: if water is the vehicle for infection, take the water out. In Senegal, children given the paste (Plumpy'nut) gained 15.6 g/kg/day against 10.1 on F-100 (Diop 2003, via Collins 2006b and Ashworth 2006). Mark Manary's group in Malawi then showed that it worked at home. In Blantyre, 95% of 282 HIV-negative children over one year old recovered on home RUTF, against 78% on standard foods. That is a relative risk of 1.2 (95% CI 1.1 to 1.3). Weight gain was 5.2 against 3.1 g/kg/day (Manary 2004, abstract only). In a larger controlled effectiveness study of 1,178 children, 79% recovered at home on RUTF against 46% on standard care. Relapse or death was 8.7% against 16.7% (Ciliberto 2005, abstract via search summary). Among children with oedema, 83% (182 of 219) recovered and 5% died (Ciliberto 2006, abstract via search). A secondary source reports that 80% of 2,417 children in a Malawi operational programme recovered and 0.4% died. The primary paper was not identified [VERIFY].

**Community therapeutic care.** Collins and colleagues analysed 21 community programmes run in Malawi, Ethiopia and North and South Sudan between 2000 and 2005. Across 23,511 cases, 79.4% recovered, 4.1% died and 11.0% defaulted. Coverage was about 73%, and 76% of children were treated only as outpatients (Collins 2006b). The cost was US$12 to $132 per year of life gained (Collins 2006b). Before this, hospital case fatality for severe malnutrition ran at 20% to 30% and coverage under 10% (Collins 2006a, abstract only). A Cochrane review of 15 studies and 7,976 children compared RUTF with alternative diets. RUTF raised recovery (RR 1.33, 95% CI 1.16 to 1.54, moderate certainty), added 1.12 g/kg/day of weight gain (low certainty), and may have reduced relapse (RR 0.55, very low certainty). Its effect on death was unclear (RR 1.05, 95% CI 0.51 to 2.16, very low certainty) (Schoonees 2019). Standard and alternative RUTF formulas performed about the same for recovery (RR 1.03, high certainty) (Schoonees 2019).

### 4. The WHO ten steps and what they did to mortality

WHO's ten steps (WHO 1999, WHO 2003, by Ann Ashworth, Sultana Khanum, Alan Jackson and Claire Schofield) are these:

1. Treat or prevent hypoglycaemia.
2. Treat or prevent hypothermia.
3. Treat or prevent dehydration.
4. Correct electrolyte imbalance.
5. Treat or prevent infection.
6. Correct micronutrient deficiencies, giving no iron at first.
7. Start cautious feeding.
8. Achieve catch-up growth.
9. Provide sensory stimulation and emotional support.
10. Prepare for follow-up.

Stabilisation takes days 1 to 7 and rehabilitation weeks 2 to 6.

**Mortality with and without.** WHO states that hospital case fatality of 30% to 50% can be cut to under 5% with the protocol. A review of 67 studies found that median case fatality had not changed in five decades, and one child in four was still dying in the 1990s (WHO 2003, preface). At the ICDDR,B hospital in Dhaka, mortality fell from 17% to 9% after a standard protocol was introduced, and later to 3.9% (WHO 2003). The protocol was reported in the Lancet (Ahmed 1999). In the Eastern Cape of South Africa, case fatality fell from 46% to 21% at Mary Theresa Hospital and from 25% to 18% at Sipetu Hospital. At Sipetu it then rose back to 38% when untrained doctors rotated in (Ashworth 2004, abstract only). WHO's benchmarks are: over 20% unacceptable, 11% to 20% poor, 5% to 10% moderate and under 5% good (WHO 2003). In Yaoundé, Cameroon, local home-made F-75 and F-100 gave a case fatality of 21.9% (9 of 41). All the deaths were in HIV-positive children within 72 hours (Nguefack 2015).

**When children die tells you what went wrong** (WHO 2003). Deaths in the first 24 hours point to low blood sugar, cold, sepsis, severe anaemia or the wrong fluid. Deaths within 72 hours point to feeds too large or the wrong formula. Deaths at night point to cold or missed night feeds. Deaths at the change to F-100 point to a transition made too fast.

### 5. Signs and measurements

**Mid-upper-arm circumference (MUAC).** In children aged 6 to 59 months, MUAC under 115 mm is severe acute malnutrition and 115 to 125 mm is moderate (MSF 2026, ACF about 2011). MUAC predicts death better than weight-for-height. In data from Bangladesh, Senegal and Uganda, MUAC alone outperformed weight-for-height, weight-for-age and height-for-age, and correcting for age or height added little (Myatt 2006). Lay workers can take it in the field with a tape or a marked string (THRIVING library, FO-04, FO-07). In Guatemala, four of five volunteers

could not calculate weight-for-height unsupervised (Myatt 2006). For a village after the Fall, MUAC and oedema are the measures, and weight-for-height tables are for the district.

**Oedema.** Pitting oedema of both feet means severe malnutrition whatever the arm measures (WHO 1999, MSF 2026). Press both thumbs on the top of both feet for about three seconds. A pit that stays after the thumbs lift is oedema (THRIVING library, FO-07 [VERIFY the 3 seconds there]). In adults, other causes must be ruled out first: pre-eclampsia, kidney disease, filariasis, heart failure and wet beriberi (WHO 1999).

**Weight-for-height.** Under -3 Z-scores on the WHO growth standards is severe wasting. WHO 2003 used under 70% of the median. Children with oedema may not gain weight for the first days, because fluid leaves as tissue is built. Progress then shows as shrinking oedema rather than weight (WHO 1999).

**Adults.** BMI 18.5 or more is normal. BMI 17.0 to 18.49 is mild undernutrition, 16.0 to 16.99 moderate and under 16.0 severe. Admit at BMI under 16 or with oedema (WHO 1999). Where a person cannot stand, estimate height from half arm span: height = 0.73 × (2 × half arm span) + 0.43 (WHO 1999). The formula's units are not clear in the extracted text, and it should be checked against the original before use [VERIFY]. There is no international consensus on adult MUAC cut-offs. Search summaries mention one national algorithm using MUAC under 19 cm and an MSF figure of 160 mm, neither confirmed in a primary source [VERIFY]. Collins reported adults surviving refeeding at BMI as low as about 9 in Somalia, Sudan and Angola in the 1990s (Collins 1995, not read in full) [VERIFY].

**Appetite test.** A child with SAM who eats a test dose of RUTF and has no complications can be treated at home. A child who refuses it is admitted (MSF 2026, Collins 2006b). Loss of appetite usually means the body is overwhelmed by infection.

### 6. Home-made therapeutic food

**F-75 and F-100 from kitchen ingredients.** WHO gives recipes from dried skimmed milk, whole dried milk or fresh cow's milk, with sugar, vegetable oil and the electrolyte and mineral solution (EMS). Each is made up to 1000 ml with cooled boiled water. The second column of the table below is WHO's 1999 manual. Nguefack (2015) used the WHO whole-milk versions independently in a Cameroon hospital, with rice flour.

| Feed (to 1000 ml) | WHO 2003 | WHO 1999 | Nguefack 2015 |
|---|---|---|---|
| F-75, skimmed milk, with cereal | milk 25 g, sugar 70 g, flour 35 g, oil 30 g, EMS 20 ml | same, but oil 27 g | not used |
| F-75, whole dried milk, with cereal | milk 35 g, sugar 70 g, flour 35 g, oil 20 g | same, but oil 17 g | milk 35 g, sugar 70 g, rice flour 35 g, soy oil 20 g, plus 22.5 ml 10% KCl |
| F-75, fresh cow's milk, with cereal | milk 300 ml, sugar 70 g, flour 35 g, oil 20 g | same, but oil 17 g | not used |
| F-75 without cereal | skimmed milk 25 g, sugar 100 g, oil 30 g | skimmed milk 25 g, sugar 100 g, oil 27 g | not used |
| F-100 | skimmed milk 80 g, sugar 50 g, oil 60 g | same | not used |
| F-100, whole dried milk | milk 110 g, sugar 50 g, oil 30 g | same | milk 110 g, sugar 50 g, oil 30 g |
| F-100, fresh cow's milk | milk 880 ml, sugar 75 g, oil 20 g | same | not used |

Sources: WHO 2003, WHO 2002, WHO 1999 and Nguefack 2015.

The 1999 and 2003 versions differ by 3 g of oil in most recipes. That is within the 5 g accuracy of the scale WHO asks for (WHO 2002). They also differ on cooking. WHO 1999 says to boil the cereal versions for 5 to 7 minutes, and WHO 2003 says 4 minutes. F-75 without cereal has an osmolarity of about 415 mOsm/l, which children with diarrhoea may not tolerate. The cereal version is about 334 (WHO 2003, WHO 1999). F-75 gives 75 kcal and 0.9 g protein per 100 ml. F-100 gives 100 kcal and 2.9 g protein (WHO 2003).

WHO's training module names the traps (WHO 2002). Add water up to the 1000 ml mark, because adding a full litre makes the feed about 15% too dilute. Use cooled boiled water. Throw away made-up feed after 24 hours, and without a cold store make it for each feed.

**The electrolyte and mineral solution (EMS).** WHO 2003 gives the amounts per 2,500 ml and WHO 1999 per 1,000 ml. Scaled to 1,000 ml they agree to within rounding: potassium chloride 89.5 g, tripotassium citrate 32.4 g, magnesium chloride hexahydrate 30.5 g, zinc acetate 3.3 g, copper sulphate pentahydrate 0.56 g. Sodium selenate and potassium iodide may be left out if they cannot be weighed. Twenty millilitres go into each litre of feed or ReSoMal. Twenty millilitres supply 24 mmol potassium, 3 mmol magnesium, 300 μmol zinc and 45 μmol copper (WHO 2003). The sources differ on storage. WHO 1999 says the solution keeps at room temperature. WHO 2003 says to refrigerate it, discard it if it turns cloudy and make it fresh each month. Where EMS cannot be made, WHO 2003 allows a 10% potassium chloride stock (100 g per litre) at 22.5 ml per litre of milk feed or 45 ml per 2 litres of ReSoMal. Magnesium can then be given as 50% magnesium sulphate by intramuscular injection, 0.3 ml/kg up to 2 ml, and zinc as a 1.5% zinc acetate solution at 1 ml/kg/day. Nguefack (2015) used exactly the 22.5 ml potassium chloride fallback. Too much potassium stops the heart, so this belongs at the dispensary, made by weight by one trained person.

**ReSoMal.** This is rehydration solution for the severely malnourished, with less sodium and more potassium than ordinary ORS. Both WHO 1999 and WHO 2003 make it from one packet of standard WHO ORS dissolved in 2 litres of water instead of 1, plus 50 g sugar and 40 ml EMS. The result has about 45 mmol sodium, 40 mmol potassium and 3 mmol magnesium per litre. MSF's ready-made sachet (84 g per 2 litres) gives the same sodium and potassium. MSF warns that it must be used within 24 hours, has caused low blood sodium, and is not for cholera (MSF ReSoMal 2026). HY-03 gives the version with 45 ml 10% potassium chloride in place of EMS, which matches the WHO fallback (THRIVING library, HY-03). The reference was the old WHO ORS (3.5 g sodium chloride, 2.9 g trisodium citrate, 1.5 g potassium chloride and 20 g glucose per litre). With the newer reduced-osmolarity ORS, the arithmetic changes [VERIFY].

**RUTF made locally.** Manary (2006) gives the most widely used recipe by weight: full-fat milk powder 30%, sugar 28%, vegetable oil 15%, peanut butter 25% and mineral and vitamin mix 1.6%. Energy is about 5.5 kcal/g. Only this one primary source with percentages was read. A commercial web page found by search gives the same figures, so the recipe is listed as single-sourced [VERIFY]. The production rules matter more than the recipe (Manary 2006):

- Grind every ingredient to particles under 200 microns.
- Add no water at all.
- Do not heat the oil above 45 °C.
- Embed the protein and sugar in the fat.

Manary is blunt about hand-mixing. Although it is possible, the product "is so inconsistent that it cannot be reliably used" (Manary 2006). A 40-litre planetary mixer made 25 kg batches in Malawi. Peanuts must be sorted, because black or shrivelled nuts carry aflatoxin. The limit is 10 to 20 parts per billion. Malawi production was lab-tested weekly for Salmonella, aflatoxin and composition. Unsealed jars keep 3 to 4 months, and foil packs flushed with nitrogen keep 24 months. The finished product cost about US$2.60 per kg (Manary 2006). The mineral and vitamin premix came from a single French producer, Nutriset. Without it, the paste is a high-energy peanut spread, not a therapeutic food.

**Contamination.** The brief's pitfall says home-made RUTF trials showed contamination and lower weight gain. The record read for this report does not quite support that. Locally made factory RUTF in Malawi did as well as imported

RUTF. Recovery was 80% against 75%, with a weight gain difference of 0.4 g/kg/day (95% CI -0.6 to 1.4) (Sandige 2004, abstract via search summary). The documented contamination problems are elsewhere. In 2012 detailed testing found Enterobacteriaceae, including Cronobacter species, at low levels in RUTF from every UNICEF-approved producer (Piper 2018, search summary). There is no validated microbial kill step for a lipid paste, so safety depends on clean ingredients and handling (Piper 2018). ENN's special supplement on local production records an aflatoxin incident at a Malawi production site in April 2003 (ENN undated). No trial of household-made RUTF with microbiological testing was found. The village danger is real but unmeasured.

**Local foods instead of RUTF.**

- **Khichri.** In Delhi, khichri was made from rice 100 g, green gram (*Vigna radiata*) 60 g, groundnut oil 20 ml, spinach 100 g and water 640 ml. It gave about 100 kcal and 3.1 g protein per 100 g, against 545 kcal and 13.6 g in RUTF. Malnourished children ate a median 242 g of khichri against 56 g of RUTF, but took in less energy from it (242 against 305 kcal) (Dube 2009). The volume needed is the limit.
- **Egg-suji.** In the Rohingya camps, the starting recipe was 1 egg (50 g), rice powder 30 g, sugar 15 g, oil 10 g and about 200 ml water, giving 324 kcal. By month 3 it was 1 egg, 75 g suji, 15 g sugar and 25 g oil, giving 614 kcal and 15.4 g protein. Of 645 children with MUAC under 115 mm, fed 5 times a day, one died and weight gain was about 5 g/kg/day. There was no control group, and the paper contains internal inconsistencies (Roy 2022). Khichuri was offered first but the families rejected it as an everyday dish (Roy 2022).
- **Khichuri and halwa with home visits.** In Dhaka, mothers practised cooking khichuri and halwa in hospital and then fed their children at home. They received home visits, zinc, folate, multivitamins and iron, but no food. No child died, and weight gain was 10 g/kg/day (Ahmed 2002, via Ashworth 2006). The gram quantities of the ICDDR,B recipes were not found.
- **Thinning cereal with sprouted grain.** Amylase-rich flour made from germinated wheat (*Triticum aestivum*) cut the viscosity of khichuri by 97% and of rice porridge by 98%. That lets more energy fit into a volume a child can swallow. Osmolality rose, for khichuri from 154 to 526 mOsm/kg (Wahed undated, secondary summary) [VERIFY].
- **What failed.** Ashworth's review found milk, sugar and oil rations ineffective in Trinidad and Jamaica. A maize and soy premix failed in Kenya and Malawi even at 72 kg a month, because of sharing, too few meals, too much water and infection (Ashworth 2006).

WHO's minimum for a home diet is at least 150 kcal/kg/day and 4 g protein/kg/day, in at least 5 meals. The foods should carry about 100 kcal and 2 to 3 g protein per 100 g, and 20 ml EMS should be added daily (WHO 2003).

### 7. Adolescents and adults

WHO's adult chapter is short and rests on experience, not trials (WHO 1999). Admit at BMI under 16 or with oedema. Feed F-75 by nasogastric tube for the first days if needed, at the hourly rates in section 1. Give antibiotics and vitamin A 200,000 IU, except in pregnancy. Adults soon become very hungry and refuse the formula. WHO then advises traditional foods with added oil and mineral and vitamin mix, and presenting the formula as a medicine. Treatment can end when the person is eating well and gaining weight, with supplements until BMI reaches 18.5.

### 8. Feeding the acutely ill

**Fluids first.** A sick person who is dry needs water and salts before food. ORS and its home version are covered in HY-03. The famine rule changes the rate. In severe malnutrition, rehydrate by mouth or tube with ReSoMal at 5 ml/kg every 30 minutes for 2 hours, then 5 to 10 ml/kg an hour for up to 10 hours. The total is usually 70 to 100 ml/kg over 12 hours. Stop if breathing or pulse quicken, neck veins swell or oedema grows (WHO 1999, WHO 2003). Intravenous fluid is for shock only. It easily overloads the starved heart (WHO 1999).

**Diarrhoea.** Keep feeding. Rice-based ORS cut stool output in the first 24 hours by 36% in adults with cholera and

32% in children with cholera, but by only 18% in children with other diarrhoea (Gore 1992, abstract via search summary). The later Cochrane update found no clear benefit in children with non-cholera diarrhoea, and a separate trial found rice ORS and WHO ORS equal when feeding was resumed promptly (Gore 1992 search summary, Fontaine 2007 abstract via search). The lesson is that food itself is the cereal. Continue breastfeeding and normal meals once the person is rehydrated, which is usually within 4 hours (THRIVING library, HY-03 [VERIFY timing there]).

**Fever.** "Feed a cold, starve a fever" has one serious test, in mice. Ruslan Medzhitov's group found that feeding, through glucose, increased deaths in bacterial infection and protected against death in influenza (Wang 2016). It has not been shown in people. The practical reading, an inference, is not to force food on a feverish person for a day or two, but always to give fluids and some sugar, and to feed as soon as appetite returns [VERIFY].

**Pneumonia.** No trial of feeding regimens in pneumonia was found. A breathless child cannot suck or eat and may choke. Small frequent feeds or expressed breast milk by cup, or a nasogastric tube, are standard practice (WHO 1999 on tube feeding when intake is under 80 kcal/kg/day). Fluids must not be pushed, because overload worsens breathing [VERIFY].

**After surgery.** Early feeding within 24 hours of bowel surgery did not raise complications. The 2006 Cochrane review by Andersen, Lewis and Thomas found mortality the only outcome with a significant difference (RR 0.41, 95% CI 0.18 to 0.93), with weak evidence and no clear mechanism (Andersen 2006, secondary summary). A 2009 meta-analysis of 13 trials and 1,173 patients by the same authors also found lower mortality (Lewis 2009, abstract and secondary summary). The old rule of nil by mouth until the bowel opens has no support. Start sips, then fluids, then soft food, as soon as the patient is awake and not vomiting.

### 9. Feeding the unconscious

NU-02 will cover the unconscious patient. For feeding, the record is brief. Never put food or fluid into the mouth of someone who cannot swallow or protect the airway, because it goes into the lungs. In the FOOD trial (Dennis 2005), 859 stroke patients who could not swallow were given either early tube feeding or none for at least a week. Early tube feeding gave an absolute reduction in the risk of death of 5.8%, which was not statistically significant. Death or poor outcome fell by only 1.2%. The authors judged that early tube feeding may save lives at the cost of more survivors with disability (Dennis 2005, secondary summary). WHO uses nasogastric feeding routinely for malnourished children who take less than 80 kcal/kg/day (WHO 2003). A soft tube, a measured length, a check that it sits in the stomach and feeds of F-75 or thin gruel given slowly by gravity are a district skill, not a household one [VERIFY: technique to be set out in NU-02].

### 10. Invalid cookery: broth, gruel, congee

**What the traditions say.** Across Europe, China and South Asia, the sick were given warm liquid food: beef tea and chicken broth, barley water and oatmeal gruel, rice congee (*Oryza sativa*), khichri of rice and lentil (*Lens culinaris*) or mung bean, and milk puddings. These were held to be easy on the stomach and restoring. This summary is general knowledge, not drawn from an ethnographic source read for this report [VERIFY].

**What the record shows.** Very little was measured. Chicken soup slowed the movement of white blood cells in a laboratory dish, more or less in step with its concentration. The active part was not identified, and some commercial soups worked better than a grandmother's recipe (Rennard 2000). Nothing clinical follows from that. The strongest evidence for a cereal gruel is rice ORS in cholera (Gore 1992).

**What science infers.** The traditions were right about small, frequent, liquid feeds, salt for the dry patient, and cereal with legume for better protein. They were wrong about energy. Gruel and broth are mostly water. A cup of broth gives little energy and little protein. In Dhaka, ordinary rice gruel and khichuri could not deliver a weaning child's needs because they were either too thick or too bulky (Wahed undated) [VERIFY]. For the severely malnourished, salty broth is harmful, because the body already holds too much sodium (WHO 2003). The useful modern version

of invalid cookery is the energy-dense gruel: cereal thinned with sprouted grain, made rich with oil and sugar, with milk or egg added. F-75 is itself a sweet milk gruel with oil.

## Evidence grades

| Practice | Grade | Basis |
|---|---|---|
| WHO ten-step protocol in hospital | B | Before-and-after series, replicated in Bangladesh and South Africa, with no randomised trial of the whole (WHO 2003, Ashworth 2004) |
| Slow start, low sodium, added potassium and magnesium | B | Physiology, the 1945 record and clinical series (Hemstreet 2024, WHO 2003) |
| NICE adult refeeding limits | B for the danger, D for the exact numbers | Consensus, with no trials (Mehanna 2008) |
| Thiamine before feeding | B | Consensus and physiology (NHS Highland 2025) |
| Home RUTF for uncomplicated SAM | A | Cochrane review of 15 studies and 7,976 children, plus controlled studies (Schoonees 2019, Ciliberto 2005) |
| Locally made factory RUTF | A for equivalence | Sandige 2004, Schoonees 2019 |
| Hand-mixed household RUTF | D | No trial found, and Manary 2006 advises against it |
| Home-made F-75 and F-100 from WHO recipes | B | WHO 2003, Nguefack 2015 |
| ReSoMal instead of standard ORS in SAM | B | Consensus, and MSF reports low blood sodium |
| MUAC and oedema for detection | A/B | Prospective mortality studies (Myatt 2006) |
| Home diet of khichuri and halwa with home visits | B | Ahmed 2002, Khanum 1994, via Ashworth 2006 |
| Egg-suji | C | One uncontrolled series (Roy 2022) |
| Continued feeding in diarrhoea | A | Trials summarised in Gore 1992 |
| Early feeding after surgery | A | Andersen 2006, Lewis 2009, with weak certainty |
| Early tube feeding in stroke | A, not significant | Dennis 2005 |
| Withholding food in fever | D | Mouse data only (Wang 2016) |
| Broth and chicken soup as medicine | D | In vitro only (Rennard 2000) |
| Energy-dense gruel thinned with sprouted grain | C | Mechanism and viscosity data (Wahed undated) |
| Army rations, protein hydrolysates or intravenous fluids for the starving | X | Belsen 1945 (Somerville College 2020), WHO 1999 |
| Diuretics for nutritional oedema, early iron, high-protein feeds in kwashiorkor | X | WHO 1999, WHO 2003 |

## Means ledger

| Rung | Detection | Stabilisation | Rehabilitation | What it changes |
|---|---|---|---|---|
| Hands and knowledge | MUAC string, thumb test for oedema, appetite test, count breaths and pulse | Keep warm skin to skin, sugar water against low blood sugar, breastfeed | Five or more small meals a day | Prevents night deaths from cold and low blood sugar |
| Hearth | The same | Cooled boiled water, sugar, salt, milk feeds made by measure, ORS diluted for ReSoMal | Khichuri, egg-suji, oil-enriched gruel | Gets energy in, but without minerals recovery stalls and phosphate may fall |
| Garden and still | Scale, register of MUAC readings | Weighed F-75 from milk powder and sugar, with cereal from the garden | Sprouted-grain gruel, peanuts (*Arachis hypogaea*) sorted by eye, sesame (*Sesamum indicum*), soya (*Glycine max*) | Recipes become reproducible, and the aflatoxin risk appears |
| Village dispensary | Weight-for-height tables, growth charts | EMS or 10% potassium chloride made by weight, amoxicillin, vitamin A, tube feeding | Batch RUTF with a mixer if a premix exists, home visits | This is where the Bangladesh results were achieved: mortality under 5% is possible |
| District infirmary | Haemoglobin, blood glucose, microscopy | Intravenous glucose and fluids for shock, blood transfusion, gentamicin, magnesium injection | Inpatient F-100, lab-tested RUTF | Treats the complicated case and the adult at highest risk |
| Hospital before the Fall | All of the above, plus electrolytes daily | Measured phosphate, potassium and magnesium replacement, monitoring | Commercial RUTF | Case fatality under 5% in good units, 20% to 30% in many real ones |

## Harm test

- **Feeding too much too soon.** This killed at Belsen and at the 72-hour mark in hospitals. Signs are breathing up by 5 or more a minute and pulse up by 25 or more on two readings 4 hours apart, puffy eyelids, swelling liver or new oedema (WHO 2003). MSF uses breathing up by 10 or pulse up by 20 (MSF 2026). The response is to stop feeds for an hour or two, then restart at a smaller volume.
- **Too much salt.** Ordinary ORS, salty broth or intravenous saline loads a body already holding sodium and causes heart failure (WHO 1999).
- **Potassium preparations.** A weighing error in EMS or 10% potassium chloride can stop the heart. Kidney failure, with no urine passed, is a reason to stop potassium [VERIFY]. One person should make it, and a second check the label.

- **Dilution and dirt.** Over-diluted feed starves, and feed left standing breeds bacteria. Peanut paste can carry aflatoxin, and adding water to a paste invites growth.
- **Iron too early.** Iron given in the first week increased deaths (WHO 2003). Give it only once the child gains weight.
- **High-protein feeds in kwashiorkor.** Can be fatal (WHO 2003).
- **Intravenous fluids.** Raise mortality except in shock (WHO 2003).
- **Diuretics for oedema.** Never (WHO 1999).
- **Who must never receive the standard regimen without change.** Infants under 6 months need breast milk or diluted F-100, not RUTF [VERIFY]. Pregnant women should not get high-dose vitamin A (WHO 1999). The old and those with heart or kidney disease need the slowest start. Adults with alcohol dependence need thiamine first.
- **Misidentification.** Grass pea (*Lathyrus sativus*) is a famine food that causes lathyrism, a permanent paralysis, when eaten as the main food for months [VERIFY]. Bitter cassava (*Manihot esculenta*) must be soaked and cooked to remove cyanide [VERIFY]. Mouldy maize (*Zea mays*) and peanuts carry aflatoxin.

## Red flags

These signs mean the patient may die without care the village cannot give:

- loss of appetite despite treatment
- no weight gain or oedema not shrinking by day 10 (WHO 1999)
- temperature under 35.5 °C rectal or 35.0 °C under the arm
- blood sugar under 3 mmol/l, or drowsiness and limpness
- fast breathing or a rising pulse after feeds
- severe anaemia (palms white), with Hb under 4 g/dl needing transfusion of 10 ml/kg over 3 hours (WHO 2003)
- corneal ulcer or clouding from vitamin A deficiency
- an adult at BMI under 13 [VERIFY]
- HIV or tuberculosis

What to do anyway: keep the patient warm, feed small amounts every two hours day and night, give antibiotics if any are held, and keep breastfeeding. Honest comfort is part of care. In Yaoundé, all nine deaths came within 72 hours in children with HIV (Nguefack 2015). Some will die whatever is done. Tell the family that the first three days are the most dangerous. If a child is dying, stop the feeds and the tube, keep the child held and warm, and give sips only if wanted.

## The case against

- **Steve Collins and the outpatient critics** argued that the inpatient WHO model killed by crowding and infection and reached under 10% of those in need (Collins 2001, Collins 2006a). If the village builds a feeding centre, it may reproduce the failure.
- **Ann Ashworth** showed that many community programmes failed, with only a third effective overall. Rations were shared and diluted (Ashworth 2006). Home feeding without minerals, follow-up and trust is no cure.
- **Mark Manary** said that hand-mixed RUTF is not reliable (Manary 2006). The village paste is not RUTF.
- **The Cochrane authors** found RUTF's effect on mortality uncertain (Schoonees 2019). The best evidence is for recovery, not survival.
- **Golden and Grellety** warned that cheaper recipes with less milk risk phosphate deficiency (ACF about 2011). Substitution can kill quietly.
- **Hemstreet and Weisz** caution that refeeding deaths in 1945 cannot be cleanly separated from infection and exhaustion (Hemstreet 2024). The 1945 numbers are not a trial.

Romance of the hospital: a protocol run by untrained doctors at Sipetu went back to 38% mortality (Ashworth 2004). Romance of tradition: broth and gruel cannot carry enough energy to rebuild a wasted child.

## 10-line summary

1. Starved bodies hold too much sodium and too little potassium, magnesium and phosphate. Feeding fast can stop the heart.
2. Start low. Children get 100 kcal/kg/day of F-75 in 12 feeds. Very wasted adults start at about 5 to 10 kcal/kg/day and reach full needs over 4 to 7 days.
3. After the first week, feed lavishly: 150 to 220 kcal/kg/day for children and about 4,000 kcal a day for a young man.
4. The WHO ten steps cut hospital mortality from 30% to 50% to under 5% where staff were trained.
5. Famine kills mostly through infection. Water, measles vaccination and antibiotics belong to famine medicine.
6. MUAC under 115 mm or oedema of both feet identifies the child at risk better than weight-for-height.
7. Home treatment with RUTF beats inpatient care for uncomplicated cases and reaches 70% or more of those in need.
8. Hand-mixed paste without the mineral premix is not RUTF. Home diets need added minerals and support to work.
9. Keep feeding in diarrhoea, and feed early after surgery.
10. Broth and gruel are right in form and wrong in energy. Make them dense with oil, sugar, milk, egg and sprouted grain.

## Open questions

- What starting energy level is safe for a famine adult without blood tests: WHO's 40 kcal/kg or NICE's 5 to 10?
- Can a village make a mineral premix without laboratory-grade salts?
- How much phosphate does a low-milk F-75 or paste need?
- Did household RUTF ever undergo a contamination study?
- What are the ICDDR,B khichuri and halwa recipes by weight?
- Is the 1945 death toll from refeeding separable from that from infection?
- Do adults need their own MUAC cut-off?

## Sources to read in full

1. WHO 2003, *Guidelines for the inpatient treatment of severely malnourished children*.
2. WHO 1999, *Management of severe malnutrition*, including the adult chapter.
3. Food and Nutrition Bulletin 27(3) supplement, 2006, especially Ashworth, Collins and Manary.
4. ACF International, *Guidelines for the integrated management of SAM*, by Golden and Grellety.
5. Keys 1950, *The Biology of Human Starvation* (not read).
6. Winick 1979, *Hunger Disease* (not read).
7. Mehanna 2008, BMJ.
8. Schoonees 2019, Cochrane review of RUTF.

## At the bedside after the Fall

**Household.** Measure the arm with a string marked at 115 and 125 mm. Press both feet for oedema. Count breaths. Keep the sick child warm against the mother's skin, give sugar water if feeds are late, and give small feeds every 2 to 3 hours, day and night. Breastfeed throughout. To start, the household needs a string, a cup, a spoon, sugar, oil, milk or egg, cereal and a clock. The first failure to expect is sharing. The sick child's food goes to the siblings.

**Village of 300.** A trained lay healer with a scale accurate to 5 g, a measuring jug, milk powder, sugar and oil can make F-75 and F-100. A dispensary holds ORS packets, potassium chloride, magnesium, zinc, amoxicillin and vitamin A. Keep a register of names, MUAC, oedema, weight, and date started. Expect 1 or 2 severe cases a month in famine [VERIFY: inference]. The first failure to expect is feeding too much in the first 3 days because the child seems hungry.

**District of 3,000.** Add a ward with ten beds, a nurse, a blood glucose meter, haemoglobin testing, gentamicin and intravenous glucose. Make RUTF in batches with a mixer if a premix exists, test peanuts for aflatoxin and train home visitors. The first failure to expect is the Sipetu problem: a good protocol abandoned when the trained staff leave.

## Protocols

### Protocol A. First 7 days for a severely malnourished child (WHO 2003)

- ☐ On arrival, give 50 ml of 10% sugar water (1 rounded teaspoon of sugar in 3.5 tablespoons of water). Then give F-75 every 30 minutes for 2 hours, a quarter of the 2-hourly feed each time.
- ☐ Take the temperature. If under 35.0 °C under the arm, warm the child skin to skin and recheck every 2 hours until above 36.5 °C. No hot water bottles.
- ☐ Give an antibiotic even with no fever. WHO 2003 gives co-trimoxazole paediatric suspension 5 ml twice daily for 5 days. MSF 2026 gives amoxicillin 50 mg/kg twice daily, maximum 1 g a dose, for 5 to 7 days.
- ☐ Give vitamin A on day 1: 200,000 IU over 12 months of age, 100,000 IU at 6 to 12 months, 50,000 IU under 6 months.
- ☐ Give F-75 at 130 ml/kg/day, or 100 ml/kg/day with severe oedema.
- ☐ Days 1 to 2: 11 ml/kg every 2 hours. Days 3 to 5: 16 ml/kg every 3 hours. Days 6 to 7: 22 ml/kg every 4 hours. Night feeds are not optional.
- ☐ Tube feed if the child takes less than 80 kcal/kg (105 ml/kg) a day.
- ☐ Record breathing and pulse every 4 hours. If breathing rises by 5 or more or pulse by 25 or more on two readings, cut the volume.
- ☐ No iron. No diuretic. No added salt.

### Protocol B. Rehydration in severe malnutrition (WHO 1999, WHO 2003)

- ☐ Make ReSoMal: one standard ORS packet in 2 litres of boiled water, plus 50 g sugar, plus 40 ml EMS or 45 ml 10% potassium chloride.
- ☐ Give 5 ml/kg every 30 minutes for 2 hours by cup, spoon or tube.
- ☐ Then 5 to 10 ml/kg an hour for 4 to 10 hours. Usually 70 to 100 ml/kg in all.
- ☐ Give 50 to 100 ml after each watery stool.
- ☐ Stop if breathing or pulse quicken, neck veins swell or eyelids puff. Reassess after 1 hour.
- ☐ Throw away after 24 hours (MSF).

### Protocol C. Catch-up feeding (WHO 2003)

- ☐ When appetite returns, switch to F-100 at the same volume for 48 hours.
- ☐ Then add 10 ml per feed until some is left over, up to 30 ml/kg per feed (200 ml/kg/day).
- ☐ Aim for 150 to 220 kcal/kg/day and 4 to 6 g protein/kg/day.
- ☐ Weigh daily. Under 5 g/kg/day is poor, 5 to 10 moderate, over 10 good.
- ☐ Start iron at 3 mg/kg/day once weight gain begins.
- ☐ End treatment at 90% weight-for-height, or MUAC over 125 mm with no oedema for 2 weeks (MSF 2026).

**Protocol D. Refeeding a starving adult (Mehanna 2008, WHO 1999)**

- ☐ Give thiamine 200 to 300 mg a day by mouth, starting 30 minutes before the first feed and continuing for 10 days.
- ☐ Days 1 to 3: 5 to 10 kcal/kg/day as milk or thin cereal, in small feeds every 2 hours.
- ☐ Days 4 to 7: rise to full needs (about 40 kcal/kg/day) if pulse, breathing and ankles stay steady.
- ☐ Add potassium and magnesium if available, and keep milk in the diet for phosphate.
- ☐ Watch daily for breathlessness, ankle swelling, confusion or weakness. Halve the food if they appear.
- ☐ From week 2, feed freely: three meals and snacks with added oil.

## Numbers to carry

1. MUAC under 115 mm means severe malnutrition in a child aged 6 to 59 months.
2. Oedema of both feet means severe malnutrition.
3. Start F-75 at 100 kcal/kg/day, never more, for the first week.
4. Very wasted adult: 5 to 10 kcal/kg/day at first, with thiamine before food.
5. Feeds every 2 hours, day and night, for the first two days.
6. Breathing up by 5 or pulse up by 25 means slow the feeds.
7. Blood sugar under 3 mmol/l: give 50 ml of 10% sugar water.
8. Catch-up: 150 to 220 kcal/kg/day.
9. Good weight gain: over 10 g/kg/day.
10. Case fatality under 5% is the target, and over 20% means something is wrong.

## References


1. ACF International (about 2011). *Guidelines for the integrated management of severe acute malnutrition: in- and out-patient treatment*. Protocols by Michael H. Golden and Yvonne Grellety. Action contre la Faim International, Paris. https://medbox.org/index.php/dl/5e148832db60a2044c2d1d8d (full text, refeeding and phosphorus sections read. Year of publication not confirmed.)
2. Ahmed T and others (1999). Paper on mortality of severely malnourished children with diarrhoea under a standardised management protocol at ICDDR,B (exact title not confirmed). *Lancet* 353:1919. https://pubmed.ncbi.nlm.nih.gov/10371570/ (not read. Known through WHO 2003 and a search summary.)
3. Ahmed T, Islam MM, Nahar B, Azam MA, Salam MA, Ashworth A, Fuchs GJ (2002). Home-based nutritional rehabilitation of severely-malnourished children recovering from diarrhea and other acute illnesses. Paper presented at the 10th Annual Scientific Conference, ICDDR,B, Dhaka, 11 to 13 June 2002 (not read. Known only through Ashworth 2006, reference 5.)
4. American RadioWorks (undated). The Minnesota starvation experiment. American Public Media. https://americanradioworks.publicradio.org/features/wwii/a2.html (read.)
5. Andersen HK, Lewis SJ, Thomas S (2006). Early enteral nutrition within 24h of colorectal surgery versus later commencement of feeding for postoperative complications. *Cochrane Database of Systematic Reviews* CD004080. https://cochranelibrary.com/cdsr/doi/10.1002/14651858.CD004080.pub2/information/es (results known only through a secondary summary. Updated in 2019 as CD004080.pub4.)
6. Ashworth A (2006). Efficacy and effectiveness of community-based treatment of severe malnutrition. *Food and Nutrition Bulletin* 27(3 suppl):S24 to S48. https://archive.unu.edu/unupress/food/FNB_v27n3_suppl.pdf (full text read. Also the source for Khanum 1994, Ahmed 2002 and Diop 2003.)
7. Ashworth A, Chopra M, McCoy D and others (2004). WHO guidelines for management of severe malnutrition in rural South African hospitals: effect on case fatality and the influence of operational factors. *Lancet* 363:1110 to 1115. https://pubmed.ncbi.nlm.nih.gov/15064029/ (abstract only.)

8. Belsen.co.uk (undated). Arnold Peter Meiklejohn. https://www.belsen.co.uk/arnold-peter-meiklejohn/ (search summary only.)
9. Briend A, Lacsala R, Prudhon C, Mounier B, Grellety Y, Golden MHN (1999). Ready-to-use therapeutic food for treatment of marasmus. *Lancet* 353:1767 to 1768. https://www.groupenutriset.fr/wp-content/uploads/2023/12/evidences-plumpy-nut.pdf (letter not read. Known through the manufacturer's evidence summary and Wikipedia, both secondary.)
10. Centers for Disease Control (1992). Population-based mortality assessment: Baidoa and Afgoi, Somalia, 1992. *Morbidity and Mortality Weekly Report*. https://www.cdc.gov/MMWR/preview/mmwrhtml/00018099.htm (summary read.)
11. Christian Science Monitor (2 November 1984). The world responds to grim scenes of Africa's worst drought: a plea for help from the hungry. https://csmonitor.com/1984/1102/110219.html (search summary only.)
12. Ciliberto MA, Sandige H, Ndekha MJ, Ashorn P, Briend A, Ciliberto HM, Manary MJ (2005). Comparison of home-based therapy with ready-to-use therapeutic food with standard therapy in the treatment of malnourished Malawian children: a controlled, clinical effectiveness trial. *American Journal of Clinical Nutrition* 81(4):864 to 870. https://iro.uiowa.edu/esploro/outputs/journalArticle/Comparison-of-home-based-therapy-with-ready-to-use/9983905524502771 (abstract and secondary summaries only.)
13. Ciliberto H and others (2006). Home-based therapy for oedematous malnutrition with ready-to-use therapeutic food. *Acta Paediatrica*. https://iro.uiowa.edu/esploro/outputs/journalArticle/Home-based-therapy-for-oedematous-malnutrition-with/9983905645802771 (abstract via search summary only.)
14. Collins S (1995). The limit of human adaptation to starvation. *Nature Medicine* 1(8):810. https://doi.org/10.1038/nm0895-810 (not read. Known through secondary reports.)
15. Collins S (2001). Changing the way we address severe malnutrition during famine. *Lancet* 358:498 to 501. https://library.alnap.org/node/53079 (abstract and secondary summaries only.)
16. Collins S, Dent N, Binns P and others (2006a). Management of severe acute malnutrition in children. *Lancet* 368:1992 to 2000. https://pubmed.ncbi.nlm.nih.gov/17141707/ (abstract only.)
17. Collins S, Sadler K, Dent N and others (2006b). Key issues in the success of community-based management of severe malnutrition. *Food and Nutrition Bulletin* 27(3 suppl):S49 to S82. https://archive.unu.edu/unupress/food/FNB_v27n3_suppl.pdf (full text read.)
18. Dennis MS and others, FOOD Trial Collaboration (2005). Effect of timing and method of enteral tube feeding for dysphagic stroke patients (FOOD): a multicentre randomised controlled trial. *Lancet* 365:764 to 772. https://clinical-brain-sciences.ed.ac.uk/research/completed-studies-trials/food-stroke-trials (secondary summary only.)
19. Diop EHI, Dossou NI, Ndour MM, Briend A, Wade S (2003). Randomised trial of RUTF against F-100 in Senegal (exact title not confirmed). *American Journal of Clinical Nutrition* (not read. Known through Ashworth 2006 and Collins 2006b, references 6 and 17.)
20. Dube B, Rongsen T, Mazumder S, Taneja S, Rafiqui F, Bhandari N, Bhan MK (2009). Comparison of ready-to-use therapeutic food with cereal legume-based khichri among malnourished children. *Indian Pediatrics* 46:383 to 388. https://indianpediatrics.net/may2009/may-383-388.htm (full text read.)
21. Emergency Nutrition Network (undated). Local production of RUTF. *Field Exchange*, special supplement. https://ennonline.net/fex/102/4-3-1 (read. Date of the supplement not confirmed.)
22. Fontaine O, Gore SM, Pierce NF (2007). Rice-based oral rehydration solution for treating diarrhoea. *Cochrane Database of Systematic Reviews* CD001264. https://pesquisa.bvsalud.org/ses/resource/es/mdl-17636662 (abstract via search summary only. Listed as withdrawn in one database.)
23. Gore SM, Fontaine O, Pierce NF (1992). Impact of rice based oral rehydration solution on stool output and duration of diarrhoea: meta-analysis of 13 clinical trials. *BMJ* 304:287. https://www.bmj.com/content/304/6822/287 (abstract via search summary only.)
24. Hektoen International (2022). The Warsaw Ghetto hunger study. https://hekint.org/2022/01/06/the-warsaw-ghetto-hunger-study/ (read.)

25. Hemstreet DE-S, Weisz GM (2024). One page in the history of starvation and refeeding. *Rambam Maimonides Medical Journal* 15(2):e0010. https://pmc.ncbi.nlm.nih.gov/articles/PMC11065092/ (full text read. The source for the 1945 series of Burger, Collis, Mollison, Mitchell and Black, Walters and Schnitker, none read in the original.)
26. Keys A, Brožek J, Henschel A, Mickelsen O, Taylor HL (1950). *The Biology of Human Starvation*. University of Minnesota Press, Minneapolis (not read.)
27. Khanum S, Ashworth A, Huttly SRA (1994). Controlled trial of three approaches to the treatment of severe malnutrition. *Lancet* 344:1728 to 1732 (not read. Known through Ashworth 2006, reference 6.)
28. Lewis SJ, Andersen HK, Thomas S (2009). Early enteral nutrition within 24 h of intestinal surgery versus later commencement of feeding: a systematic review and meta-analysis. *Journal of Gastrointestinal Surgery* 13:569. https://www.springermedizin.de/early-enteral-nutrition-within-24-h-of-intestinal-surgery-versus/9010116 (abstract via search summary only.)
29. Manary MJ, Ndkeha MJ, Ashorn P, Maleta K, Briend A (2004). Home based therapy for severe malnutrition with ready-to-use food. *Archives of Disease in Childhood* 89:557 to 561. https://pmc.ncbi.nlm.nih.gov/articles/PMC1719944 (abstract only.)
30. Manary MJ (2006). Local production and provision of ready-to-use therapeutic food (RUTF) spread for the treatment of severe childhood malnutrition. *Food and Nutrition Bulletin* 27(3 suppl):S83 to S89. https://archive.unu.edu/unupress/food/FNB_v27n3_suppl.pdf (full text read.)
31. Mehanna HM, Moledina J, Travis J (2008). Refeeding syndrome: what it is, and how to prevent and treat it. *BMJ* 336:1495 to 1498. https://pmc.ncbi.nlm.nih.gov/articles/PMC2440847/ (full text read.)
32. Médecins Sans Frontières (consulted 2026). Malnutrition aiguë sévère. *Guide clinique et thérapeutique*. https://medicalguidelines.msf.org/fr/viewport/CG/francais/malnutrition-aigue-severe-16689430.html (read in French. Cited as MSF 2026.)
33. Médecins Sans Frontières (consulted 2026). ReSoMal, rehydration solution for malnutrition, oral. *Essential drugs*. https://medicalguidelines.msf.org/viewport/EssDr/english/resomal-rehydration-solution-for-malnutrition-oral-16684569.html (read. Cited as MSF ReSoMal 2026.)
34. Moore PS and others (1993). Mortality rates in displaced and resident populations of central Somalia during 1992 famine. *Lancet* 341:935. https://burnet.edu.au/knowledge-and-media/research-articles/mortality-rates-in-displaced-and-resident-populations-of-central-somalia-during-1992-famine (abstract via search summary only.)
35. Myatt M, Khara T, Collins S (2006). A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs. *Food and Nutrition Bulletin* 27(3 suppl):S7 to S23. https://archive.unu.edu/unupress/food/FNB_v27n3_suppl.pdf (full text read.)
36. NHS Highland (2025). Refeeding syndrome in adults (guidelines), TAM686, reviewed 28 August 2025. https://www.rightdecisions.scot.nhs.uk/tam-treatments-and-medicines-nhs-highland/adult-therapeutic-guidelines/gastro-intestinal/refeeding-syndrome-in-adults-guidelines/ (read.)
37. National Institute for Health and Clinical Excellence (2006). *Nutrition support in adults*, clinical guideline CG32. London (not read in the original. Criteria and thiamine dose known through Mehanna 2008, NHS Highland 2025 and NHS prescribing summaries found by search.)
38. Nguefack F and others (2015). Hospital management of severe acute malnutrition in children with F-75 and F-100 alternative local preparations: results and challenges. *Pan African Medical Journal* 21:329. https://pmc.ncbi.nlm.nih.gov/articles/PMC4633737/ (full text read.)
39. Piper and others (about 2018). Invasive Cronobacter species infection in infants and children admitted to a rural Kenyan hospital with a high prevalence of malnutrition. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6113899/ (search summary only. Authors, year and journal not confirmed.)
40. Rennard BO, Ertl RF, Gossman GL, Robbins RA, Rennard SI (2000). Chicken soup inhibits neutrophil chemotaxis in vitro. *Chest* 118(4):1150 to 1157. https://lyneslab.uconn.edu/wp-

content/uploads/sites/2599/2019/10/chicken-soup-chemotaxis.pdf (abstract and press summary via search.)

41. Roy SK, Jahan K, Khatoon S, Alam N, Tasnim S, Parveen S, Ferdaus A, Cubra K (2022). Effectiveness of home-based "egg-suji" diet in management of severe acute malnutrition of Rohingya refugee children. *Journal of Health, Population and Nutrition* 41:53. https://pmc.ncbi.nlm.nih.gov/articles/PMC9700960/ (full text read through a summary tool.)
42. Sandige H, Ndekha MJ, Briend A, Ashorn P, Manary MJ (2004). Home-based treatment of malnourished Malawian children with locally produced or imported ready-to-use food. *Journal of Pediatric Gastroenterology and Nutrition* 39:141 to 146. https://nutrition-evidence.com/article/62304/home-based-treatment-of-malnourished-malawian-children-with-locally-produced-or-imported-ready-to-use-food (abstract via search summary only. Some sources date it 2005.)
43. Schoonees A and others (2019). Ready-to-use therapeutic food (RUTF) for home-based nutritional rehabilitation of severe acute malnutrition in children from six months to five years of age. *Cochrane Database of Systematic Reviews* CD009000.pub3. https://pmc.ncbi.nlm.nih.gov/articles/PMC6537457/ (read.)
44. Schwarcz J (2021). Rutabagas and weight loss. Office for Science and Society, McGill University, 23 April 2021. https://www.mcgill.ca/oss/node/8714 (read.)
45. Somerville College, Oxford (about 2020). One day in history for Holocaust Memorial Day: 15th April 1945, Bergen-Belsen and doing science in hell. https://www.some.ox.ac.uk/news/one-day-in-history-for-holocaust-memorial-day-15th-april-1945-bergen-belsen-and-doing-science-in-hell (search summary only. Year not confirmed.)
46. THRIVING library, FO-01, FO-04, FO-07, FO-11 and HY-03. Earlier reports in this series, in the same folder as this report.
47. Wahed MA, Mahalanabis D and others (undated). Work on amylase-rich flour and energy-dense weaning foods in Bangladesh (exact title not confirmed). United Nations University archive. https://archive.unu.edu/unupress/food/8F153e/8F153E0p.htm (secondary summary via search only. Authors and year not confirmed.)
48. Wang A and others, senior author Medzhitov R (2016). Opposing effects of fasting metabolism on tissue tolerance in bacterial and viral inflammation. *Cell* 166(6):1512 to 1525. https://pmc.ncbi.nlm.nih.gov/articles/PMC5555589 (abstract and press summaries via search.)
49. WHO (1999). *Management of severe malnutrition: a manual for physicians and other senior health workers*. World Health Organization, Geneva. https://medbox.org/index.php/dl/5e148832db60a2044c2d4773 (full text read in part: initial treatment, feeding, the adult chapter and the appendices.)
50. WHO (2002). *Training course on the management of severe malnutrition: Feeding*. WHO/NHD/02.4. World Health Organization, Geneva. https://medbox.org/index.php/dl/5e148832db60a2044c2d1c65 (full text read.)
51. WHO (2003). Ashworth A, Khanum S, Jackson A, Schofield C. *Guidelines for the inpatient treatment of severely malnourished children*. World Health Organization, Geneva. https://medbox.org/index.php/pdf/5e148832db60a2044c2d1edf (full text read.)
52. Wikipedia (2026a). Minnesota Starvation Experiment. https://en.wikipedia.org/wiki/Minnesota_Starvation_Experiment (secondary, read.)
53. Wikipedia (2026b). Warsaw Ghetto hunger study. https://en.wikipedia.org/wiki/Warsaw_Ghetto_hunger_study (secondary, read.)
54. Wikipedia (2026c). Biafran airlift. https://en.wikipedia.org/wiki/Biafran_airlift (secondary, read.)
55. Wikipedia (2026d). Therapeutic food, with the linked pages on F-100 and F-75 and on K-Mix 2. https://en.wikipedia.org/wiki/Therapeutic_food and https://en.wikipedia.org/wiki/K-Mix_2 (secondary, read.)
56. Wikipedia (2026e). 1983 to 1985 famine in Ethiopia (mirror copy). https://wikipedia.classicistranieri.com/en/articles/1/9/8/1984%E2%80%931985_famine_in_Ethiopia_ce28.html

(secondary, search summary only.)
57. Wikipedia (2026f). Korem. https://en.wikipedia.org/wiki/Korem (secondary, search summary only.)
58. Winick M, editor (1979). *Hunger Disease: Studies by the Jewish Physicians in the Warsaw Ghetto*. Translated by Martha Osnos. Wiley, New York (not read.)