ME-08 Minerals and simple chemicals: salt, sugar, iodine, Epsom salt, iron, zinc, sulfur, charcoal, clay, lime, bicarbonate

HEALING after the FALL, research library, ME-08

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

How to read this report

This is the mineral table for the book and the findings behind each row. It builds on six library reports and does not repeat them: oral rehydration and the teaspoon arithmetic (THRIVING library, HY-03), iodine and iron needs and seaweed iodine (THRIVING library, HY-08), charcoal dosing and the ban on salt emesis (THRIVING library, ME-14), iodine tincture, permanganate, chlorinated lime and boiled saline (THRIVING library, IN-07), the spot tests (THRIVING library, ME-13) and the sugar dressing (THRIVING library, WO-02). MA-04 (eclampsia) and NU-02 do not yet exist, so the magnesium section carries more of the obstetric record.

The minerals keep for years, look like kitchen goods, and often sit one spoonful away from a lethal dose. Each section gives dose by weight, source, purity, the village test and the harm, from two sources where two exist. No section gives a method for making an injectable, a zinc salt or activated charcoal. Where the brief asks whether such things can be made, the answer is what the record shows about those who tried.

The mineral table

Weights assume a level 5 mL teaspoon: salt about 5.9 g (THRIVING library, HY-03), Epsom salt about 5 g (Epsom salt OTC label n.d.), sugar about 2.5 g (Graz et al 2008). Spoons vary, so weigh one spoonful of each on the village scale once and write it on the jar.

Mineral	Use	Dose	Source and test	Main harm	Never give
Salt	ORS, rinses, under-skin fluid	9 g per litre saline, 3 g per litre ORS	Kitchen or sea salt, boiled	Hypernatraemia, about 1 g per kg lethal	As an emetic. Strong salt water to infants
Sugar	ORS, low blood sugar, dressings	About 0.5 g per kg under the tongue	Any clean sugar	Aspiration if poured in	As a drink to a fitting child
Iodine	Goitre, cretinism, water	150 µg a day, 250 µg in pregnancy	Iodised salt 20 to 40 mg per kg. Starch test	Thyrotoxicosis in the old. Poison at grams	Lugol's drops as a daily supplement

Mineral	Use	Dose	Source and test	Main harm	Never give
Epsom salt	Laxative. Eclampsia (ampoules only)	10 g by mouth. 4 g IV or 10 g IM loading	Bath salt by mouth only	Breathing and heart stop. Sepsis if injected impure	Kidney failure. Under 2 by mouth. Home-made injection
Iron	Iron-deficiency anaemia	65 mg elemental once a day	Salvaged tablets, iron pots. Tannate test	Child poisoning death	Within children's reach. Non-anaemic children in malaria areas
Zinc	Child diarrhoea	20 mg a day 10 to 14 days, 10 mg under 6 months	Salvaged tablets	Vomiting. Galvanised poisoning	Home-made zinc salts
Sulfur	Scabies, ringworm	5 to 10% in fat	Flowers or precipitated sulfur	Irritation. Toxic gas when burnt	By mouth
Charcoal	Swallowed poison	1 g per kg, up to 50 g, within 1 hour	Activated best. Hearth has 1/4 to 1/5 the surface	Aspiration. Useless for iron, acids, alkalis	Drowsy patient. Caustic swallow
Clay	Diarrhoea adjunct	Product dose only	Unknown earth carries lead	Lead. Anaemia association	Under 2, pregnancy, breastfeeding
Lime	Sludge and latrines	Sludge to pH 12 for 2 hours	Kiln lime	Blinding eye burns	Near eyes unprotected
Bicarbonate	Occasional heartburn, mouth rinse	Half a teaspoon, rarely	Kitchen soda	Alkalosis, stomach rupture	Heart failure, infants, daily use
Alum	Clearing muddy water	By jar test	Mineral alum	Does not disinfect	As medicine
Permanganate	Weeping skin	1 in 10,000, light pink	Salvage	Burns, poisoning	Undiluted
Copper sulfate	None	None	Salvage	Haemolysis, death	Anyone by mouth
Borax	None	None	Salvage	Infant seizures, death	Infants, soothers

Salt: saline, fluid under the skin, and poison

Tradition. Salt water is the oldest wound wash, mouthwash and gargle, and in Japan gargling is a public-health custom (Satomura et al 2005). It was also the household emetic of Europe and North America well after the 1960s (Türk et al 2005).

Record. Normal saline is 9 g per litre. IN-07 gives it boiled 15 minutes for wounds and quotes SickKids at 2 teaspoons per litre (THRIVING library, IN-07). This report disagrees slightly: at 5.9 g per teaspoon, 2 teaspoons give nearly 12 g per litre, a third stronger than normal saline. For washing a wound this is harmless. For anything put into the

body, use one and a half level teaspoons or 9 g weighed.

For mouth care, two cancer centres give one teaspoon of salt and one of baking soda in about a litre of water, swished and spat (MSK n.d.). St Jude gives 15 mL a swish and keeps the rinse up to 14 days (St Jude n.d.). The gargling trial warns against claiming too much for salt itself. Among 387 Japanese adults, plain water gargling cut respiratory infections (hazard ratio 0.60, 95% CI 0.39 to 0.95) and povidone-iodine gargling did not (0.89). Salt water was not tested (Satomura et al 2005, abstract only).

Fluid under the skin. Hypodermoclysis runs isotonic fluid into the fat of belly, chest or thigh through a fine needle. The review gives normal saline at about 1 mL a minute, no faster than 1 litre in 2 hours, about 1.5 litres per site per day and up to 3 litres a day at two sites. It is not for shock. Pulmonary oedema occurred in 0.6% of over 600 patients, and 9 of 634 patients in another series developed oedema or heart failure (Sasson and Shvartzman 2001). That record is of sterile commercial saline. I found no study of home-boiled saline given under the skin [VERIFY]. Boiling kills bacteria but does not remove pyrogens, the heat-stable fragments that cause fever and that sterile manufacture controls. The village's first choice remains ORS by mouth or nasogastric tube (THRIVING library, HY-03). Home-made saline under the skin is a last resort at the infirmary, slowly at one site, stopped at the first redness or fever [VERIFY].

Poison. Salt kills by hypernatraemia: water leaves the brain, vessels tear, and over-fast correction swells it. ME-14 gives about 1 g per kg as lethal and has struck salt emesis from the book (THRIVING library, ME-14). In Hamburg, Türk and colleagues autopsied three people given salt to make them vomit. Sodium reached 245 mmol/L, seizures and fever began within hours, and all died of cerebral oedema despite intensive care (Türk et al 2005, abstract only). A review of cases from 2000 to 2019 found 15 well-documented salt poisonings, 40% in children under 15. Half of the 14 with known outcome died. The commonest causes were salt-water emetics, salt forced on a child by a caregiver, and suicide (Metheny and Krieger 2020, abstract only). A heaped tablespoon holds roughly 15 to 20 g [VERIFY], at or above the lethal dose for a 15 kg child. Salt belongs on the high shelf with the iron.

Sugar: the hypoglycaemic child

ORS sugar is in HY-03 and the sugar dressing, graded B and changed twice daily, in WO-02. This section adds the child unconscious or fitting from low blood sugar, usually with severe malaria or after a long fast.

Record. In Mali, Graz, Dicko and colleagues treated 23 children with severe malaria and hypoglycaemia with sugar under the tongue: a level teaspoon (about 2.5 g) moistened with a few drops of water for children under 15 kg, a heaped one (about 3.5 g) above, repeated every 20 minutes. The mean dose was 0.25 g per kg, half the planned 0.5 g per kg. By 40 minutes 71% of the sublingual group and 67% of the intravenous group had reached 60 mg/dL. Failures came from clenched teeth or swallowing, and 30% relapsed. The authors advise repeating every 10 minutes (Graz et al 2008). They built on a Burkina Faso trial by Barennes and colleagues, described in their paper, in which sugar under the tongue acted faster than sugar swallowed.

Grade. B for sublingual sugar. A for sugar in ORS. B for the dressing.

Harm. Sweet liquid poured into a fitting child's mouth can be inhaled. Sugar goes under the tongue as moist crystals.

Iodine: salt, seaweed and the drop

Tradition. Burnt sponge and seaweed were used for goitre in China and in medieval Europe long before iodine was named [VERIFY]. HY-08 and IN-07 tell the seaweed and Lugol's histories.

Record. The WHO guide sets iodine in salt at production at 20 to 40 mg per kg. It assumes 20% loss before the household, 20% in cooking and 10 g of salt a day, so each person gets about 150 µg. Iodate is preferred for stability. Populations are judged by median urinary iodine (µg/L): under 20 severe, 20 to 49 moderate, 50 to 99 mild, 100 to 199 adequate, 200 to 299 above requirements, 300 or more excessive. In pregnancy under 150 is insufficient. Without iodised salt it recommends 250 µg a day or 400 mg iodised oil a year for pregnant and breastfeeding women, 150 µg or

400 mg for other women, and 90 μg or 200 mg for children under 2 (WHO 2007, read in full). The salt test kits are qualitative: a drop on a teaspoon of salt turns blue or purple if iodate is present (WHO 2007, THRIVING library, ME-13). It cannot tell 10 from 40 mg per kg.

Excess. When iodine reaches a population long deficient, older people with nodular goitre can develop an overactive thyroid, mostly in the first 5 to 10 years, so WHO advises keeping the median under 200 μg/L there (WHO 2007). In Tasmania iodate was added to bread in 1966 and thyrotoxicosis more than doubled, mostly in older people (Connolly and colleagues 1970, as reported in Richards 2021). Dairy iodine disinfectants added to the load. I found no count of deaths [VERIFY].

Seaweed and drops. Seaweed runs from 16 μg per gram in nori to 10,000 μg per gram in some kelps (THRIVING library, HY-08), so a gram of the wrong kelp a day is several times the upper limit. Lugol's 5% holds about 6 mg of iodine per drop [VERIFY]. The German risk institute warns that one drop exceeds the 600 μg upper limit about tenfold (BfR n.d.). Hesperian offers a rule for places without iodised salt: one drop of povidone iodine in a litre of water, a glass a week, for life (Hesperian 2025). My arithmetic says this gives far too little [VERIFY]. A 10% povidone-iodine solution has about 1% available iodine, so a drop holds roughly 0.5 mg, and a quarter of it a week averages under 20 μg a day. The book should not use the rule until it is checked.

Grade. A for iodised salt. C for seaweed as food. X for Lugol's by the drop as a supplement.

Epsom salt and magnesium

Tradition. Epsom salt is named after the bitter spring at Epsom in Surrey, drunk as a purge from the seventeenth century [VERIFY]. Today it is sold as a bath salt for aches, sleep and detox.

The laxative. Hesperian gives 2 teaspoons in a glass of water for adults, ½ to 1 for children of 6 to 12, ¼ to ½ for children of 2 to 6, and none under 2 (Hesperian 2025). United States labels give 2 to 6 level teaspoons (10 to 30 g) from age 12, 1 to 2 teaspoons at 6 to 11, none under 6, doses at least 4 hours apart and no more than 2 a day (Epsom salt OTC label n.d., Mayo Clinic n.d.). The brief's 10 to 15 g sits at the cautious end, and this report recommends 10 g once for an adult, because the deaths below involved larger or repeated doses. Hesperian adds 8 teaspoons per litre as a cool soak for itching. A review found the claim that magnesium soaks in through the skin scientifically unsupported (Gröber et al 2017).

Oral overdose. Healthy kidneys clear magnesium fast, but not always fast enough. A Pakistani woman of 40 with normal kidneys took Epsom salt to lose weight, arrived with magnesium of 9.7 mg/dL, arrested, was resuscitated after 35 minutes and died on day 6 (Khan et al 2018). A Chinese woman of 60 took 50 g in 150 mL as bowel preparation. A bleeding ulcer let more through. She collapsed within 30 minutes with magnesium of 8.71 mmol/L and survived only with calcium, a breathing tube and continuous kidney filtration. The authors note that few survive above 7 mmol/L (Si et al 2024). A boy of 7 died of cardiac arrest after an Epsom salt enema, magnesium 41.2 mg/dL (Tofil et al 2005). Risk rises with kidney failure, damaged or blocked bowel, enemas and repeated doses.

Eclampsia: the trials. Eclampsia is fitting in late pregnancy, birth or the days after, usually following high blood pressure and protein in the urine. The Collaborative Eclampsia Trial randomised 1,687 women who had fitted. Magnesium sulfate cut recurrent fits by 52% against diazepam (13.2% against 27.9%) and by 67% against phenytoin (5.7% against 17.1%) (Eclampsia Trial Collaborative Group 1995, abstract only). The Magpie trial randomised 10,141 women with pre-eclampsia in 33 countries. Eclampsia fell from 1.9% to 0.8%, a 58% reduction (95% CI 40 to 71), or 11 fewer fits per 1,000 women. Maternal death had a risk ratio of 0.55 (0.26 to 1.14), not certain. Baby deaths did not differ (12.7% against 12.4%). Side effects, mostly flushing, came in 24% against 5% (Altman et al 2002, secondary summaries). That is about 91 women with pre-eclampsia treated to prevent one fit, by my arithmetic [VERIFY]. For a woman who has already fitted, the gain is far larger.

Eclampsia: the dose. The WHO prequalified product sheet holds 5 g of magnesium sulfate heptahydrate in each

10 mL ampoule of 50% solution, which is 493 mg of magnesium or 20.25 mmol. It gives 4 g intravenously over 5 to 15 minutes, then 1 g an hour, never undiluted into a peripheral vein, diluted to 20% for slow injection (WHO Prequalification 2025, read in full). Hesperian gives the route for places without a drip: 5 g of 50% deep into each buttock, 10 g in all, repeated after 4 hours if needed (Hesperian 2025). This is the intramuscular half of the Pritchard regimen, in which 5 g follows into alternate buttocks every 4 hours for 24 hours [VERIFY against the original].

Eclampsia: the watch. Normal blood magnesium is 0.75 to 1.1 mmol/L. Above 1.5 blood pressure falls and vomiting begins, above 2.5 drowsiness, above 3.5 the knee-jerk goes, above 5.0 breathing slows, above 5.5 coma, above 7.0 the heart and breathing stop. A village cannot measure the blood, so it watches the body. Before every further dose the sheet requires knee-jerks present, breathing at least 16 a minute and urine at least 25 mL an hour or 100 mL in 4 hours. Some protocols use 12 breaths as the stop line [VERIFY]. The antidote is 10 to 20 mL of 10% calcium gluconate (1 to 2 g) slowly into a vein. Severe kidney disease, no urine, dehydration, myasthenia and heart block are contraindications, and the newborn is watched for 24 to 48 hours (WHO Prequalification 2025).

Can bath salt be made injectable? The record answers from people with far more than a village. In January 2005 six cardiac surgery patients in California developed *Serratia marcescens* bloodstream infections traced to intravenous magnesium sulfate from a licensed compounding pharmacy, and in March five more in New Jersey (Los Angeles County Department of Public Health 2005). In Alabama in 2011 nineteen patients fell ill and nine died after intravenous nutrition from another licensed compounder was contaminated through a sterilisation failure (Becker's ASC Review 2011). Those pharmacies had clean rooms, filters, autoclaves and inspectors. Bath salt is not made to pharmacopoeia standard, so its metals and insoluble matter are unknown [VERIFY]. No village test detects pyrogens or proves sterility. A village cannot make a safe injectable from bath salt, and trying risks killing a woman with sepsis while trying to stop her fits. What it can do is keep salvaged sealed 50% ampoules with calcium gluconate, cool and dark, and teach two people the dose and the three checks. I found no trial of oral magnesium for eclampsia [VERIFY].

Grade. A for magnesium sulfate in eclampsia. B for the laxative. X for bath absorption and home-made injection.

Iron: tablet, pot and nail

Tradition. Rust in wine or vinegar and water left on nails appear in European, South Asian and African folk medicine as blood-builders [VERIFY]. Cooking in iron pots is the household version.

The pot. HY-08 summarises the Ethiopian trial: 407 children aged 2 to 5 eating food cooked in iron pots for a year gained 1.7 g/dL more haemoglobin than those using aluminium, and iron-deficiency anaemia fell from 57% to 13% (Adish et al 1999, THRIVING library, HY-08). Wet, acidic, long-cooked foods took up iron. Legumes did not. The iron ingot dropped in the pot ("iron fish") did not raise haemoglobin in Cambodian women whose anaemia was mostly not from iron lack (Rappaport et al 2017, secondary summary). The pot works where iron is lacking and the cooking is wet.

Nails in vinegar or lemon. I found no human study, only a rat study with lemon juice (secondary, [VERIFY]). Nails may be galvanised or painted with lead. Grade D, and no method is given.

How often. The brief's 65 mg one to three times a day matches Hesperian's adult dose of one 200 or 325 mg tablet three times a day with meals (Hesperian 2025). The British Society of Gastroenterology disagrees: "initial treatment of IDA should be with one tablet per day of ferrous sulphate, fumarate or gluconate," every other day if not tolerated (Snook et al 2021). A 60 mg dose raises hepcidin, the iron-blocking hormone, for 24 hours and cuts absorption of the next dose by 35 to 45%. In older people 15 mg a day did as well as 50 or 150 mg. Haemoglobin should rise about 20 g/L within 2 to 4 weeks, with 3 months more after it normalises (Snook et al 2021). Absorption was 21.8% on alternate days against 16.3% on consecutive days (Stoffel et al 2017, secondary summary). This report sides with the guideline: one tablet a day or every other day, which also halves the stock needed. WHO recommends 30 to 60 mg a day for 3 months for women where anaemia reaches 40% (WHO 2016). 60 mg elemental is 300 mg ferrous sulfate heptahydrate, 180 mg fumarate or 500 mg gluconate.

Children. Hesperian gives half a tablet three times a day at 2 to 12 years and ⅛ to ¼ tablet crushed in food under 2 (Hesperian 2025). For a 12 kg two-year-old that is about 8 mg per kg a day, above the 2 to 6 mg per kg in the reviews I saw [VERIFY]. The Ethiopian programme gives 14 days of ferrous fumarate syrup (20 mg iron per mL): 1.0 mL at 2 to 4 months, 1.25 mL at 4 to 12 months, 2 mL or half a tablet at 1 to 3 years, 2.5 mL or half a tablet at 3 to 5 years (Ethiopia Federal Ministry of Health n.d.). The sources differ. Dose children by weight at about 3 mg per kg a day [VERIFY].

Iron kills children in two ways. By poisoning: Perth Children's Hospital classes elemental iron under 20 mg per kg as usually symptom-free, 20 to 40 as mild stomach upset, 40 to 60 as definite stomach symptoms, above 60 as systemic and above 120 as life-threatening (Perth Children's Hospital n.d.). Merck gives a similar ladder (Merck Manual n.d.). HY-08 puts toxicity from 20 mg per kg and death at 180 to 250 mg per kg. This report differs in emphasis: 20 mg per kg is the line for watching, 60 the line for danger, though some sources start toxicity at 10. For a 10 kg child, three 65 mg tablets reach 20 mg per kg and nine reach 60. Poisoning runs from vomiting and bloody diarrhoea, through a deceptive quiet phase, to shock and liver failure a day or two later (Merck Manual n.d.). Charcoal does not bind iron (THRIVING library, ME-14). The antidote is a hospital drug. Iron was once the leading cause of poisoning death in small American children, mostly from prenatal vitamins, and fell after the Food and Drug Administration required blister packs for products of 30 mg or more in 1997 (secondary summary, [VERIFY]).

By infection: on Pemba, Zanzibar, about 24,000 children aged 1 to 35 months in a malaria area received 12.5 mg iron with folic acid daily or placebo. Those given iron were 12% more likely to die or be admitted (95% CI 2 to 23), and the arms were stopped on 19 August 2003. The harm fell on children who were not iron-deficient (Sazawal et al 2006, abstract only). WHO and UNICEF then advised iron only for anaemic children in malaria areas. Without a laboratory, pale palms, conjunctivae and nail beds are the screen (THRIVING library, HY-08). Hesperian also warns against iron for the severely malnourished (Hesperian 2025).

Zinc: the diarrhoea tablet and the galvanised pot

Record. HY-03 gives the Cochrane evidence. Hesperian gives 20 mg once a day for 10 to 14 days over 6 months and 10 mg under 6 months, crushed in breast milk or water (Hesperian 2025), matching the brief. Dhingra and colleagues then randomised 4,500 children aged 6 to 59 months in India and Tanzania to 5, 10 or 20 mg for 14 days. Diarrhoea beyond 5 days occurred in 6.5%, 7.7% and 7.2%. The lower doses were noninferior with less vomiting (Dhingra et al 2020). WHO guidance has not changed [VERIFY], but a village short of tablets can halve them.

Home-made zinc. The harm record is from galvanised metal. On 19 November 1982 in Grant County, New Mexico, punch stored in corroded galvanised containers made 18 of 31 people interviewed ill within 5 minutes to 2 hours. Earlier outbreaks had zinc above 1,000 parts per million, and an adult emetic dose is 225 to 450 mg (CDC 1983). Cadmium is mined and plated with zinc, but I found no documented cadmium outbreak from galvanised vessels [VERIFY]. Scrap zinc carries whatever else was in the alloy, often lead [VERIFY], and a village cannot test for either. Zinc only from sealed salvage. No acid food in galvanised vessels.

Grade. A for zinc in child diarrhoea, including 5 to 10 mg on one large trial. X for home-made zinc.

Sulfur: the old scabies ointment

Tradition. Brimstone was burnt to fumigate houses and ships, dusted on legs against chiggers and ticks, and rubbed in for itch in European, Indian and Chinese practice [VERIFY]. Hesperian still advises dusting ankles, wrists and waist before entering tick country (Hesperian 2025).

Record. In Poland 54 scabies patients received permethrin, crotamiton or 10% sulfur ointment. At 2 weeks 100%, 66.7% and 38.9% were cured. By 4 weeks all were cured (Mila-Kierzenkowska et al 2017). The Cochrane review found only small single trials of sulfur, with no difference against lindane (68 participants) or benzyl benzoate (158) (Strong and Johnstone 2007, summary only). Sulfur works, more slowly than permethrin. It is the alternative for

pregnant women and infants under 2 months at 6% precipitated sulfur in petrolatum daily for 3 days (FPnotebook n.d., Drugs.com n.d.). Cincinnati Children's uses 5%, nightly for 3 nights, left on 8 to 14 hours (Cincinnati Children's n.d.).

The household ointment. This is a safe traditional preparation with two sources. Hesperian: "Mix 1 part of sulfur in 20 parts of Vaseline, mineral oil, or lard to form a 5 percent sulfur ointment" (Hesperian 2025, p. 374). Cincinnati Children's and FPnotebook give 5 to 6%. Hesperian adds 1 part in 10 for ringworm 3 or 4 times a day, and a lotion of 5 parts sulfur to 100 parts vinegar left to dry (Hesperian 2025, pp. 371 to 372). Use powder sold as flowers of sulfur or precipitated sulfur, not mined lumps, which may carry arsenic [VERIFY]. The whole household is treated on the same nights.

Harm. It smells, stains and irritates, more above 10%. Burning sulfur makes sulfur dioxide, dangerous in a closed room [VERIFY]. "Brimstone and treacle" by mouth has no place.

Grade. B for scabies. C for ringworm and tick dusting.

Charcoal: hearth and factory

ME-14 gives the dose (1 g per kg, up to 50 g, within 1 hour, after Chyka 2005) and finds that hearth charcoal has a quarter to a fifth of the adsorbing surface of activated charcoal (THRIVING library, ME-14).

Record. Egyptian papyri of about 1550 BC used charcoal against the smell of festering wounds. A chemist named Bertrand swallowed 5 g of arsenic trioxide with charcoal in 1813 and lived. In 1831 the pharmacist Touéry swallowed ten times the lethal dose of strychnine with 15 g of charcoal before the French Academy of Medicine and survived. Charcoal reached emergency rooms only after Holt and Holz's 1963 review "The black bottle" (Ashton and LeBlanc 2010, secondary). That source names the arsenic swallower as Gabriel Bertrand (1867 to 1962), who cannot have done it in 1813. He is usually given as Michel Bertrand [VERIFY].

Doses compared. Hesperian gives 50 to 100 g once for adults and children of 12 and over, 25 g at 1 to 12 years (50 g if serious), 1 g per kg under 1 year, and repeated doses of 25 to 50 g every 4 to 6 hours once poisoning has taken hold (Hesperian 2025). The position paper behind ME-14 caps the single dose at 50 g and does not support routine repeats. The book should follow ME-14 and treat Hesperian as an upper bound.

Activation and other claims. Industry activates charcoal at about 800 to 1,000 °C with steam or chemicals. This report gives no method. I found no good trial of charcoal for diarrhoea [VERIFY], and none for detox, wind or hangover. Charcoal also binds the patient's own medicines.

Grade. A to B for activated charcoal within an hour. C for hearth charcoal. D for wound odour. X for diarrhoea and detox.

Clay: the eaten earth

Tradition. Earth-eating is old and widespread, most often among pregnant women and children in Africa, South Asia and the American South. Clay comes from termite mounds, river banks and markets, baked into tablets in West Africa or sold as kaolin. Eaters say it settles nausea, answers a craving and protects the gut. Young's *Craving Earth* (2011), which I did not read, argues that clay protects against toxins and pathogens.

Record. A meta-analysis of 43 studies found that people practising pica had 2.35 times the odds of anaemia (95% CI 1.94 to 2.85), haemoglobin 0.65 g/dL lower, and lower zinc. Whether craving follows deficiency or causes it is unknown (Miao et al 2015). For medicinal clay, the Cochrane review of smectite in children's diarrhoea pooled 18 studies: it may shorten diarrhoea by about a day, with low certainty and no effect on admission (risk ratio 0.93) or need for drip fluids (Pérez-Gaxiola et al 2018, summary only). In March 2019 the French agency advised against diosmectite under 2 years and in pregnancy and breastfeeding because of trace lead, though adult blood lead did not

rise after 5 weeks (NPRA Malaysia 2019, relaying ANSM). In March 2016 the FDA warned against "Best Bentonite Clay", sold for detox and eating, for lead (FDA 2016, secondary summaries). The FDA dropped kaolin and pectin from its effective antidiarrhoeals in 2003 [VERIFY]. A village cannot test clay for lead or arsenic, and dug earth carries worm eggs and tetanus spores [VERIFY].

Grade. B for pharmaceutical smectite shortening diarrhoea about a day. X for clay detox, clay cures and eaten earth in pregnancy. Bentonite vendor pages are advertising.

Lime and alum: water, latrines and the eye

Tradition. Quicklime (calcium oxide) becomes slaked lime (calcium hydroxide) with water. It is chewed with betel in South Asia as chuna, used for whitewash and latrines, and used to soak maize in Mesoamerican cooking, which frees its niacin [VERIFY]. Limewater with linseed oil was Carron oil, an old Scottish ironworks burn dressing [VERIFY].

Record. Chlorinated lime is in IN-07. Plain lime does not disinfect drinking water at a drinkable dose. Its use is for excreta. Faecal sludge held at pH 12 for 2 hours and above 11.5 for 22 more meets the United States Class B standard, and the humanitarian standard cited is above 11.5 for 2 hours, at 7 to 17% of sludge weight or about 20 kg per cubic metre (Solidarités n.d.). MSF treated 600,000 litres of cholera wastewater with lime in Haiti (MSF n.d.).

Alum clumps mud so that it settles. The right dose varies tenfold with turbidity and is found by a jar test: several jars, different amounts, the smallest that clears [VERIFY]. Alum does not disinfect, so clarified water is still boiled or chlorinated.

Harm. In India children squeeze chuna packets into their eyes. Particles lodge under the lids and keep burning, so after flushing they must be picked out with a moist cloth tip, and many children need repeated surgery (Rotary News n.d.). Wet lime burns skin slowly and deeply, and quicklime heats when wet [VERIFY].

Grade. B for sludge treatment to the pH standard. C for alum clarification. X for lime or alum as medicine.

Bicarbonate: the antacid that ruptures stomachs

Tradition. Baking soda in water is the household heartburn cure in many countries, and the Sippy diet of 1915 treated ulcers with hourly milk and alkali (Medarov 2009).

Dose. Hesperian gives half a teaspoon in water as an occasional antacid and warns that frequent use makes the stomach produce more acid. It bars people with heart failure or swollen feet or face (Hesperian 2025). United States labels for 650 mg tablets allow 1 to 4 every 4 hours, no more than 24 in a day (12 from age 60), for at most 2 weeks (sodium bicarbonate OTC label n.d.). Half a level teaspoon is about 2.5 g [VERIFY], about four tablets.

Harm. California Poison Control recorded 192 people with symptoms from baking soda from 2000 to 2012, aged 2 months to 79 years: 60.4% treating indigestion, 11.5% trying to beat drug tests, 4.7% treating urinary infections. Twelve were admitted with alkalosis, high sodium, low potassium or seizures (Al-Abri and Olson 2013, abstract only). Bicarbonate on a full stomach releases gas. A review of 36 spontaneous stomach ruptures found 10 linked to bicarbonate, with 41.6% of all patients dying (Han et al 2022). With milk or calcium, alkali causes the calcium-alkali syndrome of high calcium, kidney failure and alkalosis (Medarov 2009). Acidosis is corrected in the village by correctly made ORS (THRIVING library, HY-03), not by soda.

Grade. B for occasional single-dose relief and for the mouth rinse. X for daily use and ulcers.

Permanganate, copper sulfate and borax

Permanganate is in IN-07: 1 in 10,000, light pink only, lethal adult dose 5 to 10 g, salvage only (THRIVING library, IN-07).

Copper sulfate appears in old pharmacy books as an emetic and wart caustic and was once advocated for poisoned children. In 1967 Holtzman and colleagues gave 250 mg to four children. They vomited quickly, but blood copper still rose, and the authors judged it unsafe (Holtzman et al 1967, secondary summary). It is a common means of suicide in South Asia and kills up to one in four who swallow it, through haemolysis, methaemoglobinaemia, liver necrosis and kidney failure (Meena and Bansal 2014). It has no oral use.

Borax and boric acid were nursery antiseptics. Infants died when boric acid solution was mistaken for water and when it was added to formula, after 5 to 15 g over several days, and seven infants had seizures after soothers were dipped in a borax and honey mixture (secondary summaries, [VERIFY]). Single adult ingestions are less dangerous than old texts claim: in 784 ingestions of about 10 to 88 g most had no symptoms and none died (Litovitz et al 1988, secondary summary). The danger is repeated dosing and infants. Honey on a soother also risks infant botulism. Borax has no use in the book.

Purity and the village test

ME-13's spot tests are qualitative. Applied here:

- Iodised salt: the starch test shows iodate present, not how much.
- Iron: the tannate test shows iron present. It cannot dose.
- Magnesium for injection: no village test proves sterility or absence of pyrogens, which is why the answer is no.
- Zinc, clay, seaweed: no village test for lead, cadmium or arsenic. Avoid unknown sources.
- Charcoal: comparing how fast a weighed amount decolours strong tea might rank batches [VERIFY, my untested inference].
- Salt, sugar, soda, Epsom salt: the label and the scale. Unlabelled white powders are not used.

Evidence grades

T = what the tradition says, R = what the record shows, I = what science infers.

Remedy	T	R	I	Grade
Saline wound and mouth rinse	Universal	Consensus	Isotonic, cleans	B
Commercial saline under skin	None	Series	Safe if slow	B
Home-made saline under skin	None	None found	Pyrogens, infection	D
Salt emetic	Common	Deaths	Lethal	X
Sugar under tongue	None	Two small trials	Fast	B
Iodised salt	Modern	Trials	Prevents cretinism	A
Seaweed for iodine	Coastal food	600-fold range	Food, not dose	C
Lugol's drops daily	Fringe	Regulator warning	Tenfold excess	X
Magnesium for eclampsia	Modern	Two large trials	Halves fits	A
Epsom laxative	Spa purge	Labels	Osmotic	B
Epsom bath	Wellness	Review negative	Not absorbed	X
Home-made injectable magnesium	None	Compounder outbreaks	Not feasible	X
Ferrous sulfate once daily	Modern	Guideline	As good, gentler	A

Remedy	T	R	I	Grade
Iron pots	Household	One trial	Works if deficient	B
Iron to all children in malaria areas	None	Pemba harm	Anaemic only	X
Nails in vinegar	Folk	None	Unknown dose	D
Zinc in child diarrhoea	None	Trials	5 to 20 mg works	A
Home-made zinc	None	Galvanised outbreaks	Contaminated	X
Sulfur for scabies	Many	Small trials	Slow cure	B
Activated charcoal in 1 hour	Old	Position paper	Binds many poisons	A to B
Hearth charcoal	Old	Laboratory only	Weaker	C
Charcoal for diarrhoea, detox	Wellness	None found	None	X
Smectite in child diarrhoea	Many	Cochrane, low certainty	A day shorter	B
Clay eating, clay detox	Widespread	Anaemia, lead	Harm	X
Lime for sludge	Sanitation	Standards	pH kills	B
Alum clarifying	South Asia, Europe	Engineering	Clears only	C
Bicarbonate occasional	Universal	Labels	Brief relief	B
Bicarbonate daily	Folk	Poison series	Alkalosis, rupture	X
Copper sulfate by mouth	Old herbals	Deaths	Toxic	X
Borax by mouth or soother	Old nurseries	Infant deaths	Toxic	X

Means ledger

Remedy	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Salt	Know the dose	Saline, ORS	Weighed exactly	Nasogastric ORS	Saline under skin from stock	Drip, sodium tests
Sugar	Under the tongue	Same, ORS	Same	Glucose	IV glucose	Glucose meter
Iodine	Eat seafood	Seaweed in food	Traded iodised salt, test	Supplements in pregnancy	Iodised oil if salvaged	Urine surveys
Magnesium	Spot fits, lay on side	Laxative	Scale	Ampoules, 10 g IM, checks, calcium	IV, urine measured	Blood levels, ICU

Remedy	Hands	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Iron	Spot pallor	Iron pot	Diet	Daily tablet, locked box	Colour-scale haemoglobin	Transfusion, antidote
Zinc	None	None	None	Salvaged tablets	Same	Same
Sulfur	None	5% in fat	Weighed batches	Whole households	Same	Permethrin, ivermectin
Charcoal	None	Hearth charcoal in 1 hour	Same	Activated stock	Airway care	Antidotes, dialysis
Clay	Refuse unknown clay	None	None	Smectite adjunct	Same	Rarely used
Lime, alum	Protect eyes	Latrine lime	Kiln	Sludge by pH	Chlorinated lime	Water works
Bicarbonate	None	Half teaspoon, rinse	Same	Same	IV if salvaged	Blood gases

The scale is the decisive instrument, because most mineral deaths are measuring errors. The dispensary adds the locked box and salvaged ampoules. The infirmary adds slow fluids and magnesium with urine measured, turning eclampsia from a likely death into a probable survival. Only the hospital can measure sodium, magnesium and iron in blood, give the iron antidote, ventilate for hours and correct hypernatraemia under monitoring.

Harm test

Mineral	How it harms	Signs	Response	Never
Salt	Hypernatraemia at about 1 g per kg	Thirst, irritability, high cry, fits, coma within hours	Stop salt. Correct ORS or breast milk slowly over many hours, not floods of plain water [VERIFY]. Move up	Emetic. Infants. Guessed under-skin fluid
Sugar	Aspiration	Choking	Under the tongue, child on side	Drinks to the unconscious
Iodine	Thyrotoxicosis in old goitres. Gram poisoning	Weight loss, fast heart, tremor	Reduce iodine	Lugol's daily. Kelp by the spoon
Magnesium	Breathing and heart stop. Sepsis if injected impure	Flushing, lost knee-jerk, slow breathing, drowsiness	Stop. Calcium gluconate 1 g IV slowly. Breathe for her	Low urine output. Home-made injection

Mineral	How it harms	Signs	Response	Never
Iron	Child poisoning. Infection deaths in malaria areas	Vomiting, bloody stool, quiet phase, shock	Count tablets, mg per kg, watch 6 hours, move if above 60 or shocked	Within reach. All children in malaria areas. Severe malnutrition
Zinc	Vomiting. Galvanised poisoning	Vomiting within minutes	Stop source	Acid food in galvanised metal
Sulfur	Irritation. Sulfur dioxide	Red skin. Cough	Wash off. Fresh air	By mouth
Charcoal	Aspiration. False reassurance	Cough after dose	Airway first	Drowsy patient
Clay	Lead, worms, constipation	Anaemia, colic	Stop	Under 2, pregnancy
Lime	Eye and skin burns	Pain, white cornea	Flush 30 minutes, pick out particles [VERIFY duration]	Unprotected eyes
Bicarbonate	Alkalosis, rupture, calcium-alkali	Belly swelling, twitching	Stop, move up	Daily. Infants. Full stomach
Copper, borax, permanganate	Organ failure, infant fits	Blue or brown vomit, red skin	Move up	By mouth

Historical cases: Hamburg salt emesis deaths (Türk et al 2005). Grant County punch, 1982 (CDC 1983). *Serratia* from compounded magnesium, 2005. Pemba, stopped 2003. Tasmania, 1966. California baking soda, 2000 to 2012.

Red flags

- A pregnant or newly delivered woman who has fitted, or has severe headache, blurred sight and swelling. Give magnesium if salvaged, lay her on her side, move her to the infirmary.
- A woman on magnesium whose knee-jerk has gone, whose breathing falls below 12 to 16 a minute, or whose urine stops. Stop magnesium, give calcium, breathe for her.
- A child who swallowed iron and vomits blood, or goes pale and quiet after vomiting. The quiet phase is not recovery.
- Anyone given salt water who becomes confused or fits. The brain is swelling.
- Anyone who swallowed copper sulfate, borax or permanganate.
- A lime burn with a white cornea.
- Sudden severe pain and a hard swollen belly after bicarbonate and a big meal.

What to do anyway. Keep the airway clear and the patient on the side. Breathe for the one who stops. Stop the substance. Write down what was taken, how much and when, for the next rung. Where no rung can help, keep the patient warm, clean and with family, give sips if they can swallow, and say plainly what is happening. Most mineral deaths are accidents. The family should hear that the measure failed, not their care.

The case against

Against minerals as medicine. Old does not mean safe. Metheny and Krieger (2020) and Türk and colleagues (2005) show the most trusted mineral killing people who meant to help, and Al-Abri and Olson (2013) show the same for baking soda. Holtzman (1967) showed the "safe" copper emetic was not. Gröber and colleagues (2017) reject

transdermal magnesium. Pérez-Gaxiola and colleagues (2018) found clay's evidence low in certainty, and French and American regulators found lead in clay products.

Against the minerals that work. Sazawal and colleagues (2006) showed that iron, the best-evidenced supplement, kills children who do not need it in malaria areas. Rappaport and colleagues (2017) showed a celebrated iron device doing nothing where iron was not lacking. Dhingra and colleagues (2020) found the standard zinc dose higher than needed, and Snook and colleagues (2021) that three-times-daily iron wastes iron. Good evidence still needs the right patient.

Against the romance of the hospital. Licensed compounders contaminated magnesium in 2005 and intravenous nutrition in 2011. Sugar under the tongue in Mali matched the drip.

Against this report. Several doses rest on labels, one guideline and one manual, and several figures are secondary or my arithmetic, marked [VERIFY]. Some will say a lay book should not describe an injection. I keep it because eclampsia kills women at home, Hesperian gives the same dose to lay health workers, and salvaged ampoules are better used safely than not at all.

10-line summary

1. Most mineral deaths are measuring errors. The scale and labelled jar are the main safety tools.
2. Salt kills at about 1 g per kg and is never an emetic. Saline is 9 g per litre.
3. Sugar under the tongue, repeated every 10 to 20 minutes, raised blood sugar as fast as a drip in Mali.
4. Iodised salt at 20 to 40 mg per kg prevents cretinism. Excess causes thyrotoxicosis in the old. Lugol's drops are no supplement.
5. Magnesium sulfate halves eclampsia fits. 10 g IM loading, three checks, calcium as antidote.
6. A village cannot make injectable magnesium safely. Licensed pharmacies have failed.
7. Iron: one 65 mg tablet a day or every other day. Above 60 mg per kg poisons children. Lock it away.
8. In malaria areas, iron only to anaemic children. The iron pot works where iron is lacking.
9. Zinc 10 to 20 mg a day for 10 to 14 days in child diarrhoea. Lower doses work. No home-made zinc.
10. Sulfur cures scabies slowly. Charcoal works only within the hour. Clay, borax, copper sulfate and daily soda harm.

Open questions

- Does the Hesperian iodine rule (one drop of povidone iodine per litre, a glass a week) supply enough? My arithmetic says no.
- What village dose of seaweed or Lugol's is safe where iodised salt is lost, and how is it checked without urine testing?
- The right oral iron dose for children by weight, since Hesperian and the Ethiopian programme differ.
- Whether 5 to 10 mg zinc should become the book's standard.
- Whether a single loading dose of magnesium before transfer saves lives. Bangladeshi studies exist, but I saw only titles [VERIFY].
- A village test of charcoal adsorption, and the quality of charcoal from different woods.
- Any record of home-made saline given under the skin.
- Cadmium in galvanised-vessel poisoning: suspected, not found.

Sources to read in full

1. Altman et al 2002, the Magpie trial.
2. Eclampsia Trial Collaborative Group 1995.
3. WHO Prequalification 2025, magnesium sulfate 50% product information.

4. WHO 2007, assessment of iodine deficiency disorders.
5. Snook et al 2021, BSG iron deficiency guidelines.
6. Sazawal et al 2006, the Pemba trial.
7. Adish et al 1999, the iron-pot trial.
8. Dhingra et al 2020, lower-dose zinc.
9. Hesperian 2025, Where There Is No Doctor, Green Pages.
10. Metheny and Krieger 2020, salt toxicity.

At the bedside after the Fall

Household. Needs a high shelf, labelled jars of salt, sugar and soda with the weight of one level teaspoon written on each, an iron pot, and the Numbers to carry. It can make ORS and wound saline, give sugar under the tongue, cook in iron, make sulfur ointment, and refuse salt emetics. First failure to expect: a child reaches the iron or the salt, or a grandparent mixes ORS with a tablespoon.

Village of 300. Needs a scale reading to 1 g, a locked box, salvaged ferrous sulfate, zinc, activated charcoal and sulfur, and if possible 50% magnesium sulfate ampoules with 10% calcium gluconate. Two people trained in eclampsia, the 10 g IM dose and the three checks. A poison book (who, what, how much, when), a pregnancy register and an iron register. First failure to expect: the ampoules used for something else, or the calcium missing when needed.

District of 3,000. Adds a sterile room, drip sets, urine measurement, a haemoglobin colour scale, trade in iodised salt or seaweed, and lime for sanitation. It can give magnesium IV with monitoring, saline under the skin from sealed stock, and budget iodine (about 165 g a year, THRIVING library, HY-08). First failure to expect: iodised salt runs out unnoticed, and goitre and slow children appear years later.

Protocols

1. Saline for wounds, and the mouth rinse - [ ] Clean pot with lid. 1 litre of water. - [ ] Saline: 9 g salt (tolerance 8 to 10 g), or one and a half level teaspoons. - [ ] Mouth rinse instead: 1 level teaspoon salt and 1 level teaspoon soda per litre. - [ ] Boil 15 minutes with the lid on. Cool covered. Label with the date. - [ ] Use wound saline within 24 hours [VERIFY]. Rinse keeps 14 days closed. - [ ] Rinse: 15 mL, swish 1 to 2 minutes, spit, up to 6 times a day. Never swallow.

2. Sugar for a child with low blood sugar who cannot drink - [ ] Child on the side. - [ ] Moisten a level teaspoon of sugar (about 2.5 g) with a few drops of water, a heaped one (3.5 g) above 15 kg. - [ ] Place under the tongue. No liquid into the mouth. - [ ] Repeat every 10 to 20 minutes until awake. - [ ] Then ORS or sweet drink and food. Watch 6 hours: 1 in 3 relapse. Treat the cause.

3. Epsom salt laxative - [ ] Age 6 or over, passing urine normally, no belly pain, vomiting or swollen belly. - [ ] Adult 10 g (2 level teaspoons) in a glass of water, once. Never above 30 g. - [ ] Child 6 to 12: ½ to 1 level teaspoon. - [ ] Not within 4 hours of another dose, no more than 2 a day, never as a child's enema. - [ ] Drowsiness, flushing, weakness or slow breathing: stop and seek help.

4. Eclampsia with salvaged 50% magnesium sulfate - [ ] Recognise: fit in pregnancy, birth or the days after, or severe headache, blurred sight and high blood pressure. - [ ] Left side. Clear the mouth. Nothing between the teeth. - [ ] Ampoule sealed, labelled 50%, clear, in date. Calcium gluconate 10% ready. - [ ] 10 mL (5 g) deep into the upper outer quarter of one buttock, then 10 mL into the other. Total 10 g. - [ ] Infirmary with a trained hand and a vein: 4 g IV first, diluted to 20%, over 5 to 15 minutes. - [ ] Before each further 5 g IM (every 4 hours, alternate buttocks, for 24 hours after the last fit or birth): knee-jerk present, breathing 16 or more a minute, urine 100 mL or more in 4 hours. - [ ] Any check fails: no more. Breathing slows: 10 mL of 10% calcium gluconate into a vein over 10 minutes and breathe for her. - [ ] Watch the newborn 24 to 48 hours for floppiness and poor breathing. - [ ] Move her to the infirmary. Deliver as soon as safe.

5. Iron for an anaemic adult - [ ] Pale palms, conjunctivae or nail beds. In malaria areas treat malaria first. - [ ] One 200 mg ferrous sulfate tablet (65 mg iron) once a day with vitamin C food, not tea. - [ ] Upset stomach: every other day. - [ ] Dark stools are expected. Recheck at 4 weeks. Continue 3 months after colour returns. - [ ] No better at 4 weeks: look for bleeding, worms or another cause. - [ ] Tablets counted, in a locked box.

6. Suspected iron poisoning in a child - [ ] Count missing tablets, times iron per tablet (65 mg), divided by weight in kg. - [ ] Under 20 mg per kg and well: watch 6 hours. - [ ] 20 to 60 mg per kg: watch 6 to 12 hours, fluids by mouth, prepare to move. - [ ] Over 60 mg per kg, vomiting blood, drowsiness or shock: carry to the highest rung now. - [ ] No charcoal. No salt emetic.

7. Zinc for a child with diarrhoea - [ ] With ORS and continued feeding. - [ ] Over 6 months 20 mg once a day for 10 to 14 days. 10 mg if stock is short. - [ ] Under 6 months 10 mg once a day for 10 to 14 days. - [ ] Crush in breast milk or clean water. Vomited within 30 minutes: repeat once [VERIFY].

8. Sulfur ointment for scabies - [ ] Weigh 5 g flowers of sulfur and 95 g lard or petroleum jelly. Warm the fat, stir in, stir until cool (5%). - [ ] Treat the whole household the same night. - [ ] After a bath, rub from neck to toes, between fingers and toes, under nails. Infants also scalp and face, avoiding eyes and mouth. - [ ] Leave 8 to 14 hours, wash off. Three nights running. - [ ] Boil or wash bedding and clothes, or seal them away 3 days or more [VERIFY]. - [ ] Itch may last 2 to 4 weeks. Retreat only for new burrows.

9. Bicarbonate for heartburn - [ ] Not for heart failure, swollen feet or face, infants, or after a big meal. - [ ] Half a level teaspoon in a glass of water, once, occasionally. - [ ] Needed most days: stop and look for an ulcer or other cause.

Numbers to carry

1. **9 g per litre**: saline, one and a half level teaspoons. ORS takes 3 g.
2. **1 g per kg**: the salt dose that can kill. Never salt to cause vomiting.
3. **0.5 g per kg**: sugar under the tongue, every 10 to 20 minutes.
4. **150 µg**: daily iodine, 250 µg in pregnancy. Salt carries 20 to 40 mg per kg.
5. **10 g IM**: magnesium loading, 5 g each buttock, then 5 g every 4 hours.
6. **16, 100, reflex**: breaths a minute, mL of urine in 4 hours, knee-jerk, before every magnesium dose. Calcium gluconate 1 g reverses it.
7. **65 mg once a day**: iron for an anaemic adult.
8. **60 mg per kg**: iron poisoning turns dangerous. Three tablets alarm, nine endanger a 10 kg child.
9. **20 mg for 10 to 14 days**: zinc in child diarrhoea, 10 mg under 6 months.
10. **1 hour**: the charcoal window.

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