

Guidance for Mineral & Electrolyte Concentrations in Water Used in Inpatient Therapeutic Feeding Centers

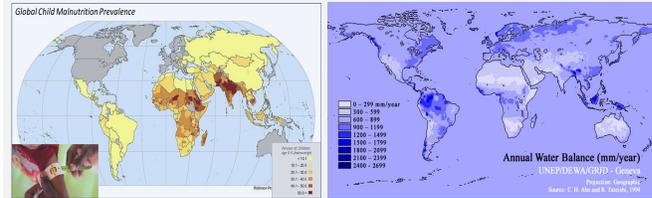
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BACKGROUND and PROJECT OBJECTIVE

High concentrations of minerals might influence treatment outcomes of Severe Acute Malnourished (SAM) patients

Unusual mortality was observed in an ITFC during the 2017 nutritional crisis in Somali region of Ethiopia. **Highly mineralized groundwater might have impacted treatment outcomes of SAM patients.** This project has the **objective** of synthesising knowledge and developing concrete guidelines for field teams.



Map of global malnutrition (left, Ciesin) and a global map of annual water balance (right, UNEP).

SAM in Dry Regions: Many regions with a high prevalence of malnutrition (above left) are reliant on groundwater. In dry regions, groundwater is likely to be highly mineralized where a low water balance results from high evaporation and low rainfall (see above right). Field teams need guidance on upper limits of minerals & electrolytes for SAM, water quality testing, and water treatment.

METHODS

① Identify those water quality parameters of most concern in ITFCs using a **toxicological risk assessment approach**:



② **Expert panel support**

- Nutritionists, water and sanitation specialists, clinicians and toxicologists
- Generate provisional recommendations
- Identify knowledge gaps

③ **Systematic literature review**

- Find all available data on upper limits of intake for minerals and outcomes for SAM patients
- Followed PRISMA and PICO approach

RESULTS: RISK ASSESSMENT

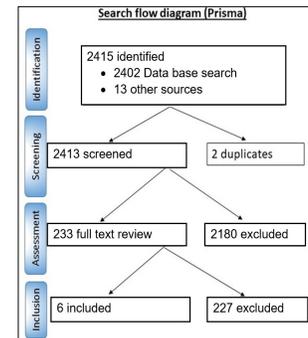
- Possible risks from **24 minerals**.
- Exposure assessment of total intake from water, milks, ORS by standard treatment protocols.
- Water in project compared with standard upper limits of intake and water guidelines from various regulatory bodies.

RESULTS: EXPERT PANEL

- **Mineral concentration of water not considered** when therapeutic milks (F100, F75) were developed!
- There are **no clear upper limits** for SAM patients
- Consider **osmolality and renal solute load (RSL)**
- **Metabolic/physiological** pathways of minerals

RESULTS: LITERATURE REVIEW

Only 6 articles found with relevant data and 3 of these were opinion pieces. **SERIOUS KNOWLEDGE GAP!**



KEY FINDINGS

Provisional Upper Limits (PUL) for 6 parameters for SAM :

- **Nitrate/nitrite Risk:** toxic, methemoglobinemia **PUL:** no evidence to deviate from existing water guidance
 - **Magnesium Risk:** osmotic diarrhoea **PUL:** laxative dose
 - **Sulphate Risk:** osmotic diarrhoea **PUL:** no evidence to deviate from existing water guidance
 - **Sodium Risk:** hyponatremia **PUL:** no evidence to deviate from existing medical guidance
 - **RSL Risk:** overload kidneys; **PUL:**RSL from food, not water
 - **Osmolality Risk:** osmotic diarrhoea **PUL:** from food, not water
- For all minerals clinical studies are needed to fine tune PUL.**

Field Water Quality Testing:

- **TDS (Total Dissolved Solids):** can establish TDS threshold based on PUL above which water may be hazardous for SAM kids; if so, elevate to test all minerals via lab + treat water
- **Nitrate:** Use rapid photometer test (does not figure in TDS)



DISCUSSION:

- An under-considered risk in ITFCs
- Potentially large problem, extent unknown: needs investigation to characterise global extent and epidemiology
- More elements need PUL: Ca, Cl, As, etc.
- Lack of field guidance
- Physiological minerals in SAM poorly understood

CONCLUSIONS

- **Guidance for field needed**
- **Extent of problem unknown, pull data from all actors**
- **Evidence lacking on limits of intake for SAM**
- **Clinical studies needed to finetune PUL**
- **Important to other situations, e.g. home situation (eg nitrate), neonatology and antenatal care**

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