RUTF LCA Analysis Report

I. Description

Ready-to-Use Therapeutic Foods (RUTFs) are essential commodities in humanitarian contexts. However, the production, distribution, and disposal of these products can have considerable environmental impacts. This study aims to evaluate the life-cycle environmental impacts of a standard RUTF product and to explore alternative scenarios that may mitigate these impacts. Specifically, it conducts a cradle-to-grave analysis of an RUTF product to establish impact indicators relevant to humanitarian use and to assess potential pathways to reduce the carbon and human health impact of the product. The baseline product considered is a 92-gram sachet, manufactured in France. It is shipped to regional logistics centres – in this case, Abidjan, Côte d'Ivoire – and distributed within a radius of 1,500 kilometres.

Supply information is as follows:

- Materials: The product is composed of peanut paste, milk powder, vegetable oil, palm oil, sugar, and a mineral mix.
- Weight: Each unit weighs 92 grams.
- Packaging: The packaging consists of aluminium, polyethylene, and cardboard, with a total packaging weight of 3.7 grams per unit.
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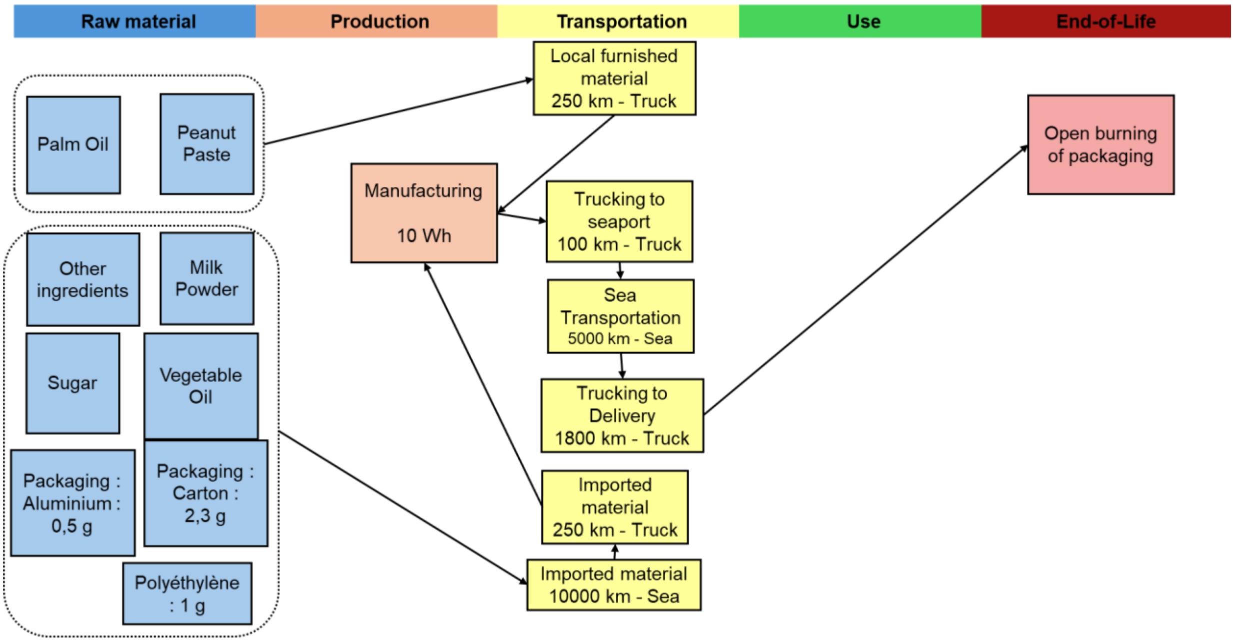
II. Methodology

Life Cycle Assessment is a standard methodology used to estimate the potential environmental impacts linked to the entire life cycle of a product or system (ISO 14040, 14044, 14067). The scope herein is a cradle-to-grave analysis, including raw material acquisition, production, transportation, use, and end-of-life (EoL) treatment. See Figure 2 below for the LCA of the baseline scenario, a RUTF sachet currently used by humanitarian organisations.



The studies utilize the data from the Ecoinvent 3.11 cut-off system model which allocates the entire impact of the material to its primary user without any 'rewards' for its potential for being recycled. EU Commission Environmental Footprint Method 3.1 and indicators were used to evaluate the scenarios using two categories. The human health indicator was aggregated to measure multiple impacts on human health as shown below. It was also normalized for one citizen so as to aggregate and represent as a single score for human health.

Both of the following indicators were weighted using the EF3.0 approach (10).

1. **Climate Change**: Global Warming Potential (GWP100 - limited to a 100-year timeframe)

2. **Impact on Human Health**:

- Human Toxicity: Carcinogenic and Non-carcinogenic
- Ionising Radiation
- Particulate Matter Formation
- Photochemical Oxidant Formation

Assumptions

<table>
<tr><th>LIFE-CYCLE STAGE</th><th>PARAMETER</th><th>DESCRIPTION OF MODEL</th></tr>
<tr><td>GENERAL</td><td>Field Context</td><td>92 grams rapid use therapeutical food used for malnourished people.</td></tr>
<tr><td rowspan="2">Raw Material</td><td>Bill of Materials</td><td>
<table>
<tr><th>Details</th><th>Quantity for 1 sachet (kg)</th><th>Range (%)</th></tr>
<tr><td>Peanut Paste</td><td>0.018-0.023</td><td>20-25 %</td></tr>
<tr><td>Milk Powder</td><td>0.027-0.032</td><td>30-35 %</td></tr>
<tr><td>Vegetable Oil</td><td>0.001-0.004</td><td>1-5 %</td></tr>
<tr><td>Palm Oil</td><td>0.014-0.018</td><td>15-20 %</td></tr>
<tr><td>Sugar</td><td>0.018-0.023</td><td>20-25 %</td></tr>
<tr><td>Others (mineral mix)</td><td>0.001-0.003</td><td>1-5 %</td></tr>
<tr><td>TOTAL</td><td>0.092</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Packaging</td><td>Aluminium, 0,4g
Polyethylene, 1 g
Cardboard 2.3 g</td></tr>
<tr><td rowspan="2">Production</td><td>Manufacturing Location</td><td>France</td></tr>
<tr><td>Manufacturing Processes</td><td>Agro-industrial process quantified to 10 Wh per sachet by manufacturer</td></tr>
<tr><td>Supply & Distribution</td><td>Transport Chain</td><td>Trucking 100 km to seaport
Sea 5000 km (Abidjan)
Trucking 300 km to warehouse
Trucking 1500 km to distribution point</td></tr>
<tr><td rowspan="2">Use</td><td>Lifespan</td><td>1 use</td></tr>
<tr><td>Usage Processes</td><td>Eaten by the beneficiary</td></tr>
<tr><td rowspan="2">Waste Management</td><td>Product Disposal Method</td><td>No disposal</td></tr>
<tr><td>Packaging Disposal Method</td><td>Open burning (no transport)</td></tr>
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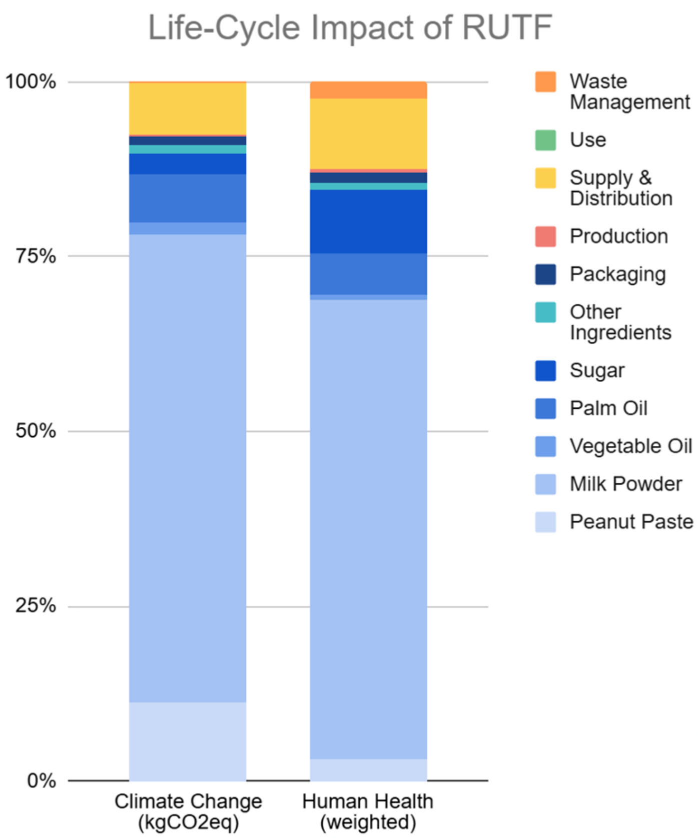


III. Scenario rationale

a. Manufacturing location

The baseline product is manufactured in France for use in sub-Saharan countries. Given the existence of multiple potential manufacturing locations, an alternative scenario exploring the impact of regionalising production has been considered. In this scenario, production is relocated to Niger, replacing the original model in which the product is manufactured in France and shipped to a Sahelian country.

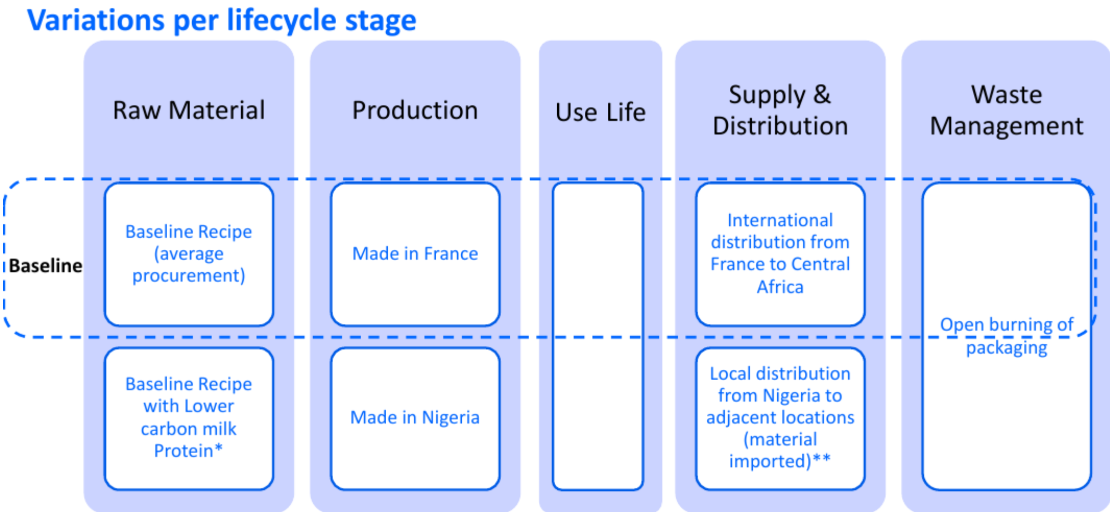
This shift significantly alters the supply chain: milk powder, peanuts, vegetable oil, the mineral mix (other ingredients), and packaging materials are now imported, while sugar and palm oil are assumed to be sourced locally, based on guidance from industry stakeholders. The energy used in the production process is attributed to the Nigerien electricity grid, and distribution is assumed to be local, involving only road transport to the designated distribution centre.

b. Milk variation

As milk has been identified as one of the main contributors to environmental impact and given that reformulating the composition of RUTF lies beyond the scope of this study, an exploratory scenario was developed to assess the impact of alternative milk production systems.

Rather than relying on the market average[1], this scenario considers milk produced in South Africa[2], which is characterised by a higher proportion of pasture-based dairy farming compared to the global average. The aim is to explore how agricultural practices influence the environmental footprint of the final product.

According to *ecoinvent* data, this type of milk production is associated with a lower carbon footprint due to more localised feeding practices and less intensive farming infrastructure. However, it may have a higher impact on human health, as manure management is typically less controlled than in intensive systems, potentially leading to greater infiltration of contaminants into local ecosystems.



IV. Results and Discussion

This study has found that the load on the environment from local manufactured products is slightly lower.

	Material	Production	Distribution	Total
Local Manufacturing	0% CC 0% HH	+617% CC -66% HH	-21% CC -22% HH	-1% CC -2% HH
Milk variation	-12% CC +5% HH	0% CC 0% HH	0% CC 0% HH	-12% CC +4% HH

[1] https://ecoquery.ecoinvent.org/3.11/cutoff/dataset/10701/documentation
[2] https://ecoquery.ecoinvent.org/3.11/cutoff/dataset/20999/documentation

Results by Category:

a) Manufacturing location

Regionalising production results in a marginal reduction of approximately 1% in climate change impacts and 2% in human health impacts. These variations are concentrated in the production and distribution phases, as the product formulation remains unchanged. Ultimately, the increased emissions associated with the more carbon-intensive electricity mix in Niger are offset by the reduced distribution requirements.

b) Milk variation

Exploration of alternative milk production systems indicates a potential reduction of 11.4% in greenhouse gas emissions at the product level. However, this scenario is associated with a 3.9% increase in impacts related to human health.

V. Discussion and Conclusions

As demonstrated in the preceding sections, the environmental impact of RUTF is largely driven by raw materials, particularly milk. Despite the implementation of two scenarios - one involving the localisation of production and another considering alternative raw material sourcing - both options yields only marginal reductions in overall impact.
Further research is required, particularly with respect to product formulation, to assess the feasibility of replacing milk proteins and other animal-derived ingredients with lower-impact alternatives.

Conclusions

- The greenhouse gas (GHG) impact of RUTF is primarily concentrated in its raw materials, with powdered milk accounting for 67% of the climate change impact and 66% of the human health impact.
- Variations in milk production methods demonstrate a small improvement in climate change impact but compensated by a degradation of the human health indicator. It is not clear enough to draw clear conclusions.
- Regionalising production has a very limited effect on reducing environmental burden but may have other benefits that are out of scope of this study.
    - ▼ 1% climate change
    - ▼ 2% impact on human health

Note: The calculations are based on impact factors from the ecoinvent 3.11 database. Several of these factors were recently updated, resulting in lower environmental impacts for certain raw materials. As a result, the current findings may differ from those of previous analyses.

References

Holloway, L., Salomon, B., Greene, A., & O'Kennedy, B. (2022). The Climate Impact of Plant-based Ready-to-Use Therapeutic Food. Clearstream Solutions report for Valid Nutrition. Available at: https://www.validnutrition.org/wpcontent/uploads/2022/10/220722_Valid-Nutrition-Report-Final-July-2022.pdf

Earth Action, The Climate Action Accelerator. (2023) 'Life Cycle Assessment of a Nutriset sachet

'Doka, G., 2018, Inventory parameters for regionalised waste disposal mixes

Ecoinvent v3.11." n.d. Ecoinvent. https://ecoinvent.org/ecoinvent-v3-11/