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WASTEWISE
Waste Avoidance Strategies for Environmental Sustainability

Nutritional Losses in Food Waste and Sidestreams, and the Environmental Impacts of Overconsumption

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LCA DF 94 - Turning Waste into Value: Life Cycle Assessment of Side Stream and Food Waste Reduction

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Why nutrition matters in FLW assessments

FLW is both an environmental and a nutrition security problem

8–10%

of global greenhouse gas emissions come from FLW (UNEP, 2024)

2 billion

people lack regular access to nutritious and sufficient food (FAO, 2020)

Yet FLW is counted in tonnes or calories, which hides what is lost

5% → 72%

meat and fish: share of waste mass vs of wasted vitamin B12 (Chen et al., 2020)

> 40%

of global needs wasted for 17 of 29 nutrients (Beuving et al., 2024)

Hidden waste

overconsumption: at least as large as consumer food waste (Sundin et al., 2021)

LCA of FLW is mass-based too: nutrient-rich and nutrient-poor waste flows are treated equally

WasteWise
Waste Avoidance Strategies for Environmental Sustainability

D2.4 - Improved methods to include FW assessment into LCA

(submitted, and accepted; publication next summer)

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Two sides of the same inefficiency



PART 1

Nutritional losses

Nutrients that never reach people, lost with FLW or diverted through sidestreams

Which nutrients, where, and do they matter for diets?

PART 2

Food Overconsumption

Intake beyond recommendations

What are the environmental and nutritional implications of shifting from current diets to recommended ones?

Both carry environmental impacts without a providing a nutritional benefit

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Part 1 - Methodology for quantifying NLs

- **Material Flow Analysis as the Physical Backbone (WASTEWISE project)**
- Matching Food and Sidestreams to **Food Composition Data (EUROFIR)**
- Defining and Calculating **Nutritional Losses (NL)**
  1. **Absolute NLs** – mass of nutrients lost (g, mg, µg/year)
  2. **% of Dietary Reference Values (DRV)*** – EFSA population-weighted nutritional requirements per day
  3. **Wasted Nutrient Days (WND)** - Nutrient lost per capita/year ÷ daily DRV, expressed as "days" of an individual's requirement lost annually (Cooper et al., 2018).
  4. **Food-group NRF** – nutritional density of lost/wasted flows, and/or sidestream per 100 g.
  - **Next step:** full nLCA

**Dietary Reference Values or DRVs are recommended intakes (e.g., g or mg of X nutrient per day per person) and they were weighted by the Swiss population's age & sex structure.*

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Part 2 - Overconsumption and its Environmental Impacts

Actual diet

National food supply 2021–2023, minus FLW and inedible parts (WASTEWISE D2.1, combining FAO and EUROSTAT data)

Recommended diet

Designed based on National Food-Based Dietary Guidelines:

- IT: CREA guidelines (2018)
- CH: Swiss Food Pyramid (2024)
- SE: Livsmedelsverket (2025)

Comparison between diets

- Over & under-consumption (g per day)
- Energy intake
- Nutritional quality (EU NRF14.3)
- Energy- and nutrient-corrected functional unit (hereafter referred to as 'nFU')

nLCA (only Italy, only GHGs as proof-of-concept application of the approach)

- GHGs of each diet
- Per daily food basket (mass) and per nutritional FU, which corrects for excess energy and lower nutritional quality

Part 2 - Methodology

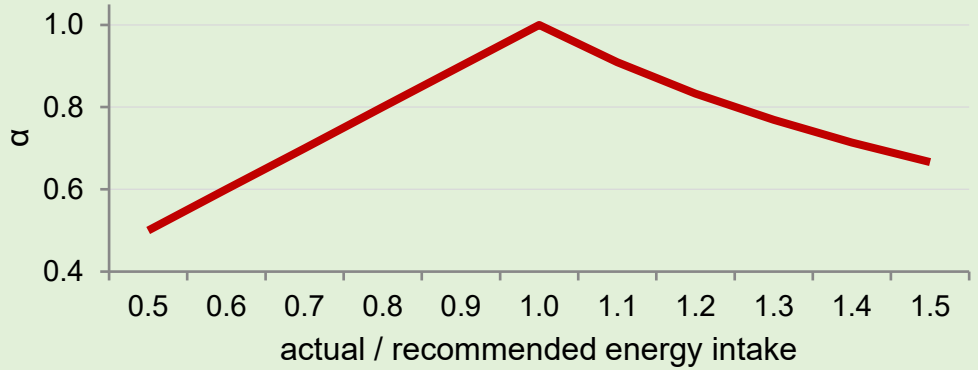
$$nFU = \alpha \times NS$$

energy score *nutrient score*

Energy score (α)

Actual vs recommended daily energy intake

α = actual / recommended if actual ≤ recommended
α = recommended / actual if actual > recommended



Under- and over-supply of energy are both penalised; α = 1 only when intake matches the recommendation

Nutrient score (NS)

Nutritional adequacy of the actual diet vs the recommended diet

NS = NRF14.3 actual diet / NRF14.3 recommended diet

NRF9.3 adapted with 5 nutrients at risk of deficiency in the EU

9 qualifying nutrients (NRF9.3)

Protein | Fibre | Vitamin A | Vitamin C | Vitamin E
Calcium | Iron | Magnesium | Potassium

+ 5 added qualifying nutrients

Iodine | **Selenium** | **Zinc** | **Folate** | **Vitamin B12**

− 3 limiting nutrients

Saturated fat | Added sugar | Sodium

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Take-home messages

METHODS

nLCA framework

- **Define FLW explicitly,** including sidestreams and by-products.
- **Nutrition in the functional unit** for whole-system studies; **as Impact indicators** for FLW-only studies.
- **Report single nutrients** (% of requirements, wasted nutrient days) and **nutrient density** (NRF)
- **Interpret** against dietary gaps and nutrition–environment trade-offs.

PART 1

Nutritional losses

- **Sidestreams are a major hidden nutritional losses losses.**
- **Hotspots move upstream** (milling, processing, slaughter) and **depend on the nutrient.**
- **Lost nutrients match dietary gaps:** fibre and folate in Italy, iron and B12 in Switzerland.
- **Valorisation potential:** bran and germ, pomace, offal as food; net benefit depends on substitution.

PART 2

Overconsumption

- **Systematic underconsumption of plant-based food groups** alongside overconsumption of meat, animal fats, and discretionary products.
- In all three countries, **the overconsumed groups contribute to degrading overall nutritional quality** of diet relative to the recommended pattern.
- **Aligning with national dietary recommendations has the potential of reducing avoidable environmental burdens while improving nutritional adequacy.**

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Next steps

Full nLCA of the three supply chains

Trade-offs between reducing nutritional losses and the associated environmental impacts

Valorisation of sidestreams

Substitution scenarios for bran, pomace and offal: nutritional and environmental performance against current uses (e.g. feed)

Overconsumption assessment

Extend the nFU-based assessment to Switzerland and Sweden and to multiple impact categories

Dissemination activities

Scoping review and nLCA framework for FLW; case-study results in peer-reviewed journals.

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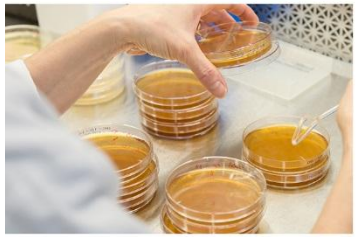


Thank you for your attention!

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