



Product-group specific approach to nutritional Life Cycle Assessment

The integration of nutritional and environmental aspects becomes particularly important when looking for solutions to reduce the environmental impact of food, since the reductions should not weaken the nutrient intake of people. To assess the effects of substituting one product with another in diets, comprehensive product-specific information that integrates both environmental and nutritional aspects is essential.

Recent developments have integrated nutritional aspects into Life Cycle Assessment (LCA). NEPGa-project led by Natural Resources Institute Finland furthers the method development by introducing a family of product group-specific nutritional functional units for the Finnish context. Following the framework and clearly defined steps, the method can also be adapted to different populations and food cultures.

Nutritional LCA

Recent developments have integrated nutritional quality into LCA through nutritional functional units, i.e., assessing the environmental impact of food in relation to nutrition provided. Previously the functional units for foods have been mass- or volume-based units, such as kg or litre.

The multi-nutrient functional units are nutrient indices, which measure the nutrient content of food in relation to the daily recommended intake. In NEPGa-project, indices to be used as a functional unit have been developed for different product groups, which represent different meal components.

Product-group specific approach^{1,2}

The grouping of foods is a crucial step in facilitating the comparison of products — it should be broad enough to cover a variety of substitutable foods while remaining narrow enough to differentiate those with distinct functions. Product grouping based on the plate model considers the functionality of the foods in meals and represents consumer behaviour because foods that are consumed similarly and are thus substitutable with each other are grouped together.



Product grouping based on the components of the plate model

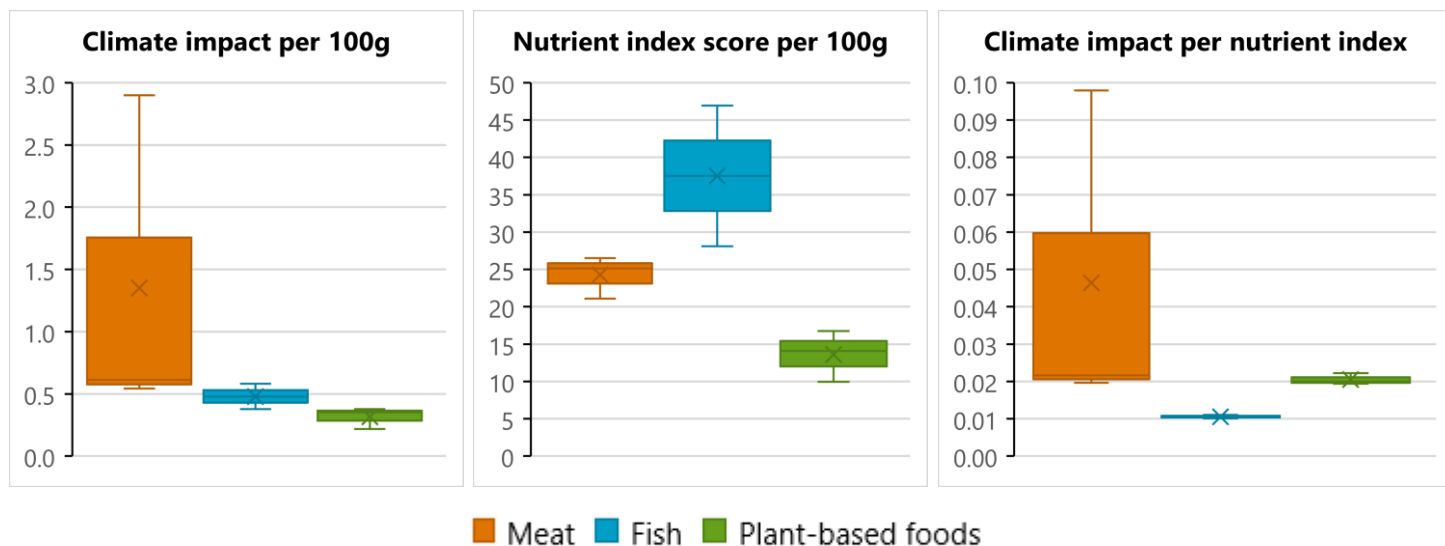
- **The Finnish plate model** is designed based on Finnish, and thus, also on the Nordic nutrition recommendations to guide consumers to compile balanced and healthy meals
- The plate model consists of half a plate of vegetables, a quarter of a plate of a carbohydrate source, and a quarter of a plate of a protein source, complemented by a drink and bread with a soft vegetable fat spread

VRN (2014) Terveystä ruoasta - Suomalaiset ravitsemussuositukset 2014. (Health from food – The Finnish nutrition recommendations)



¹Kyttä, V., Kårlund, A., Pellinen, T., Pietiläinen, O., Tuomisto, H.L., Kolehmainen, M., Pajari, A.-M., Saarinen, M., 2023. Product-group-specific nutrient index as a nutritional functional unit for the Life Cycle Assessment of protein-rich foods. Int J Life Cycle Assess. <https://doi.org/10.1007/s11367-023-02217-2>

²Kyttä, V., Kårlund, A., Pellinen, T., Tuomisto, H.L., Kolehmainen, M., Pajari, A.-M., Saarinen, M., 2023. Extending the product-group-specific approach in nutritional life cycle assessment. Int J Life Cycle Assess. <https://doi.org/10.1007/s11367-023-02235-0>



Comparing environmental impacts of food products based on nutrition results in different ranking of products than mass-based comparisons

NR-FI-indices consider:

- The NR-FI indices are product group-specific indices that represent different meal components presented in the Finnish plate model³
- The indices are formatted considering the nutrients currently obtained from the product group under study in Finnish diets
- This way, the indices used as functional units can capture the nutritional effect of substituting currently consumed foods with other ones
- The indices can be used for comparison of products within the product groups
- Comparisons of foods using these indices as functional units can produce new insights on environmental impacts and nutritional effects of changes in food consumption

NR-FI-index family:

- The NR-FI indices have been developed for use in the Finnish context, but the same approach can be adapted to tailor the indices for other populations
- The NR-FI index family includes the following indices,:
- **NR-FI_{prot}** for protein-rich foods: Protein, Ca, Fe, Se, Zn, vitamins B6 and B12, niacin, riboflavin, and thiamine
- **NR-FI_{carb}** for sources of carbohydrates: Carbohydrates, fibre, Fe, Mg, P, K, and folate
- **NR-FI_{veg}** for vegetables, fruits, and berries: Fibre, K, thiamine, vitamins C, K, and A
- Nutrients to limit (saturated fat, sodium, added sugar) should be assessed separately

³Kärlund, A., Kyttä, V., Pellinen, T., Tuomisto, H.L., Pajari, A.-M., Kolehmainen, M., Saarinen, M., 2024. Validating nutrient selection for product-group-specific nutrient indices for use as functional units in life cycle assessment of foods. British Journal of Nutrition 1–9. <https://doi.org/10.1017/S0007114524000709>



Adapting the method elsewhere – A systematic approach for harmonized nutritional LCA

Recognizing the inherent influence of cultural context on food consumption habits, our findings emphasize the need for tailoring assessment methods to the specific characteristics of the population under study.

The product group-specific approach has been tested to be adaptable in a systematic and reproducible manner for other regions, which we have demonstrated in a study adapting the methodology in a Spanish context.

Adapting the method to different populations leads to different selection of nutrients being included in the indices for each product group, which highlights the need to tailor the methodology depending on the population under study.

The development and implementation of a systematic and reproducible methodology are pivotal steps in advancing the harmonization of the nLCA method and integrating nutritional aspects into assessments of food products.

**For more information, visit our
project website:**

<https://www.luke.fi/en/projects/nepga>

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Please don't hesitate to contact us:

Principal investigator Merja Saarinen, merja.saarinen@luke.fi

Postdoctoral researcher Venla Kyttä, venla.kytta@luke.fi