Life cycle-based environmental impacts of foods using the nutritional LCA method: a case study of New Zealand avocados and Cheddar cheese

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Topics

Main function of food?

Nutrition

nLCA

Nutrition in FU (nFU)

Nutrition at Impact Assessment

Individual Nutrients → Protein
→ Calcium
→ Energy

Nutrient Profiles

NRF → **NRF$_{6.3, 9.3, 11.3, 15.3,}$ etc.**
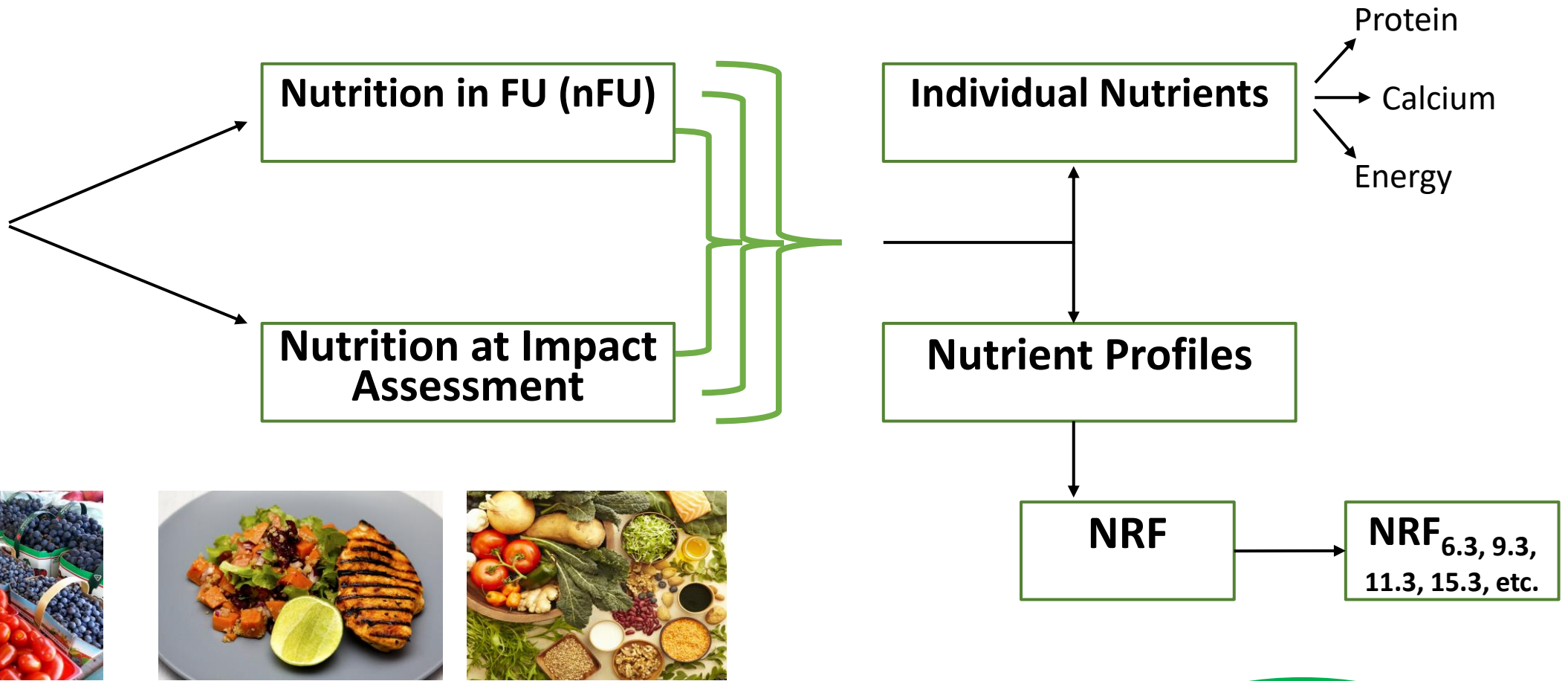
NRF$_{9.3}$

How does nutrient selection in index development influence:

a) the assessment of nutritional quality

b) the nLCA results for food items that are commonly consumed as alternatives in a single meal

Materials and Methods

❖ Survey

❖ Environmental LCA Scores – Climate Change impact

❖ Nutritional profiling

- $NRF_{9.3}$ (Fibre, proteins, vitamins A,C, E, and minerals – calcium, iron, magnesium, and potassium)

- $NRF_{20.3}$ ($NRF_{9.3}$ + PUFAs, MUFAs, vitamin D, several B-vitamins, and zinc).

- Both have three nutrients to limit – saturated fat, sodium, added sugar

- Calculated first as NR_n and LIM values (mean of qualifying (NR_n) and disqualifying (LIM) nutrients respectively in relation to NRV)

- $NRF = NR_n - LIM$

- Data Sources:
  - New Zealand Food Composition Database (2022)
  - National Medical Health and Research Council (2017)
  - Stats NZ (2023)
  - Australia New Zealand Food Standards Code (FSANZ) (2021)
  - Drewnowski et al. (2009)

❖ nLCA – nutrition impact category

- Evaluated at impact assessment in separate nutrition impact category as per McLaren et al. (2021)
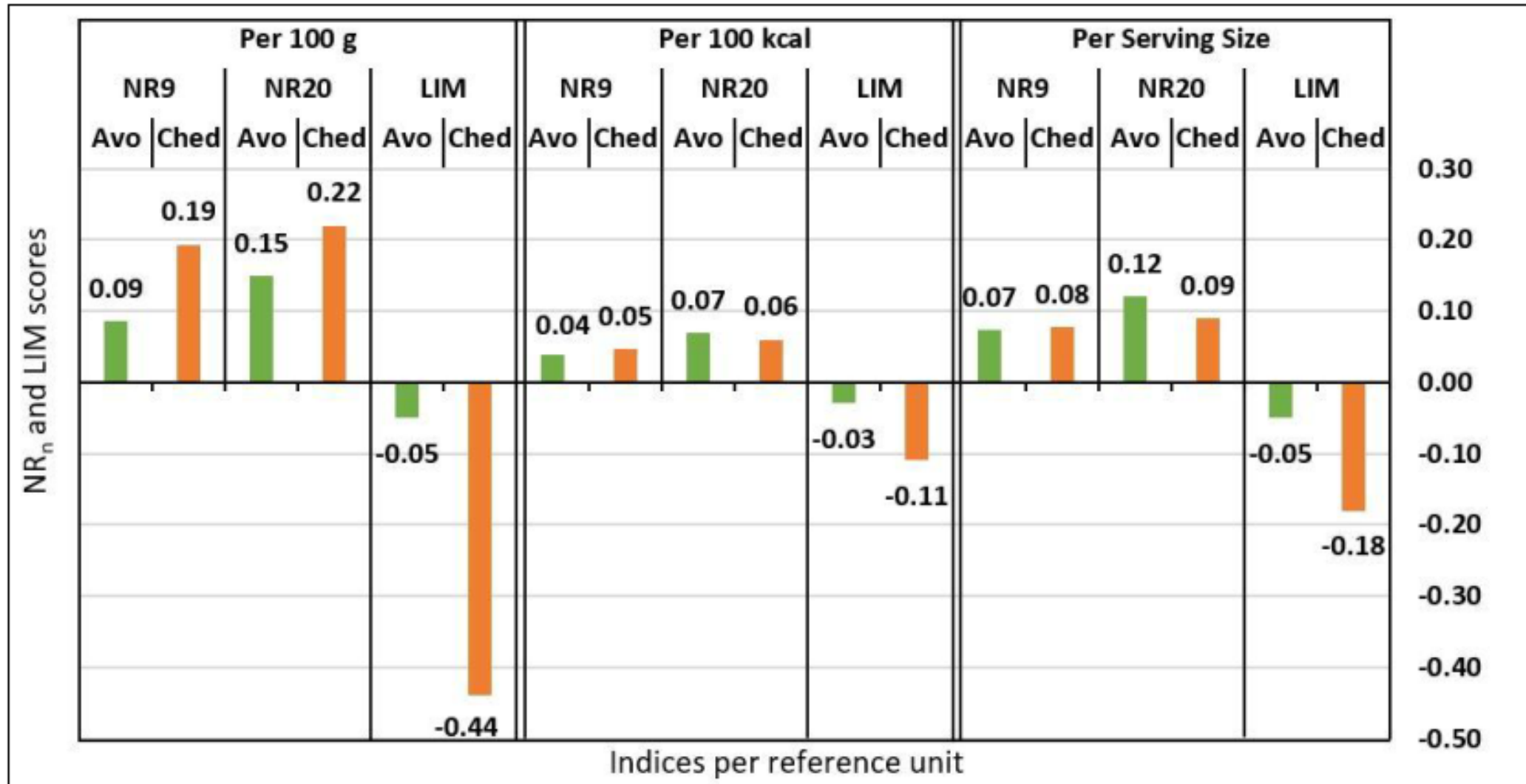
Results – NR$_n$ and LIM Scores

Figure 1. NR$_n$ and LIM scores for avocado and Cheddar cheese, based on 9 and 20 nutrients to encourage and nutrients to limit, calculated by mass, energy, and serving size
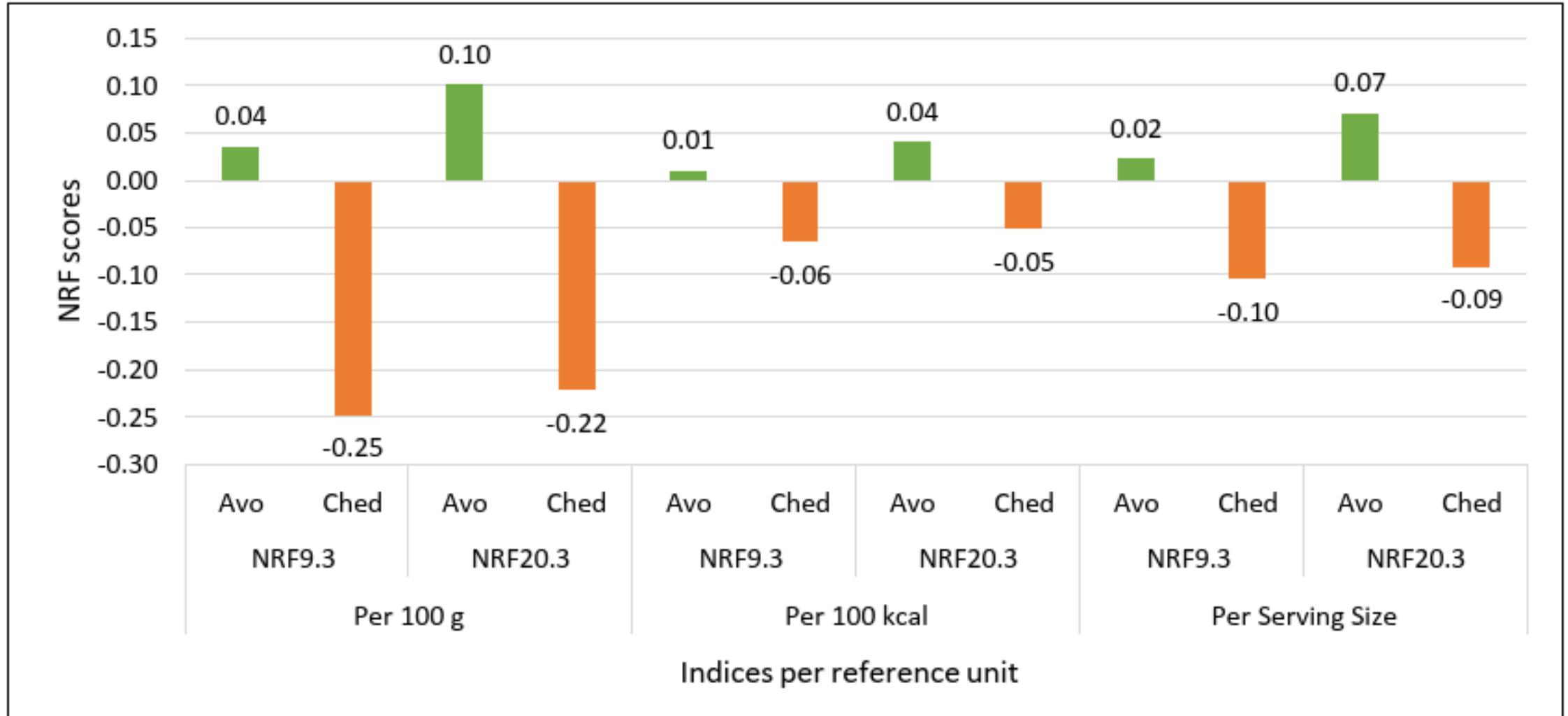
Results – NRF Scores

Figure 2. Combined NRF scores for avocado and Cheddar cheese for 9 and 20 nutrients to encourage and three nutrients to limit, by mass, energy density, and serving size.

Results – nLCA (presented per serving size)

Table 1 Environmental (climate change) impact and nutritional quality per serving size for avocado and Cheddar cheese (green and orange boxes indicate better and worse performance of the food items respectively in the nutrition and environmental impact categories)

	Avocado (85 g)	Cheddar Cheese (40 g)
GWP (kg CO_2 eq.)	0.08	0.47
NR_9	0.07	0.08
NR_{20}	0.12	0.09
LIM	0.05	0.18
$NRF_{9.3}$	0.02	-0.10
$NRF_{20.3}$	0.07	-0.09
Energy content (kcal)	186	168

Discussion

❖ Result highlight

- nLCA – avocado performs better overall for climate change impact and nutrition (except NR_9)

❖ Methodological challenges

- Negative NRF values; negative health impacts

- Choice of reference unit (mass, energy, serving size)

❖ Recommendations for future research

- Weighting

- Comparisons between vs within food groups

- The diet context

References

❖ Drewnowski, A., Maillot, M., Darmon, N. (2009). *Should nutrient profiles be based on 100 g, 100 kcal or serving size?* Eur. J. Clin. Nutr. 63, 898–904. https://doi.org/10.1038/ejcn.2008.53

❖ McLaren et al. (2021). *Integration of environment and nutrition in life cycle assessment of food Items : opportunities and challenges.* https://doi.org/10.4060/cb8054en

❖ National Medical Health and Research Council (2017). *Nutrient Reference Values for Australia and New Zealand Including Recommended Dietary Intakes.* Nutrient Reference Values for Australia and New Zealand Including Recommended Dietary Intakes | NHMRC

❖ New Zealand Food Composition Database (2022). *Food Composition Search.* Accessed April 22, 2022, from Search for a Food - New Zealand Food Composition Database

❖ Stats NZ (2023). *National Population Estimates: At 31 December 2022.* Accessed May 22, 2023, from National population estimates: At 31 December 2022 | Stats NZ

Thank You.

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