NC STATE UNIVERSITY

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Evaluate Environmental and Nutritional Sustainability of U.S. Dietary Patterns via Nutritional Life Cycle Assessment

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Introduction

Dietary patterns play a crucial role in shaping both human health and environmental sustainability. While previous dietary studies have assessed the environmental or nutritional impacts separately, few studies have integrated both metrics. These individual assessments lack identifying potential trade-offs and co-benefits between environmental sustainability and nutritional adequacy. Nutritional Life Cycle Assessment (nLCA) has emerged as an approach to address this gap by integrating environmental and nutritional metrics within a combined framework. Therefore, this study **evaluates the sustainability of five dietary patterns in the U.S. using nLCA**.

Method

- **Environmental Impact Assessment**: A farm-to-ready-for-market LCA was conducted to evaluate six environmental impacts across five dietary patterns of a 2,000 kcal daily intake for a U.S. adult.
- **Nutritional Impact Assessment:** The Healthy Eating Index (HEI-2020) was applied to assess dietary quality across 13 components with a total score (0-100), where higher scores indicate a healthier diet.
- **Integrated Assessment**: The Environmental–Healthy Eating Index (EHEI) was developed to combine environmental and nutritional impacts into a single score.

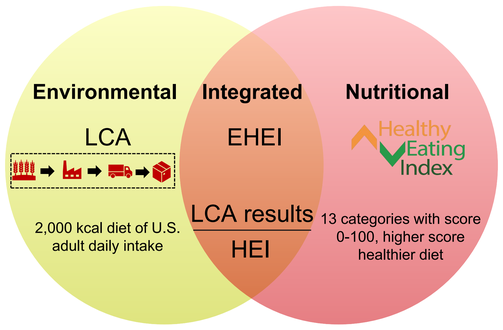

Figure 1: Environmental, nutritional, and integrated assessments in nLCA

Results & Discussion

Environmental Impact Assessment

- Diets high in **animal-source food** and **highly-processed** products showed the highest environmental burdens.
- Environmental performance varied across impact categories, emphasizing the importance of **multi-impact assessment** for comprehensively evaluating sustainability.

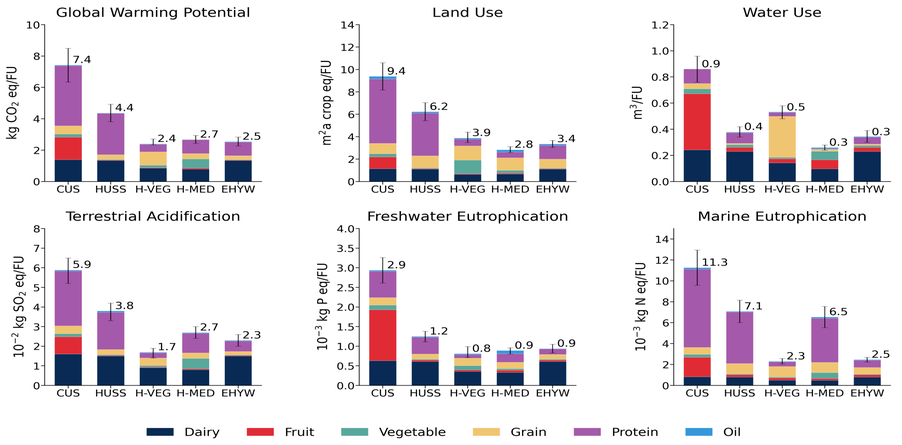

Figure 2: Environmental impact results of five dietary patterns

Nutritional Impact Assessment

- Shifting from the Current U.S. to **recommended diets** significantly **improves diet quality**.
- Diet quality was improved by changing to less/minimum processed food, diversifying protein sources, and adding high-quality fats.

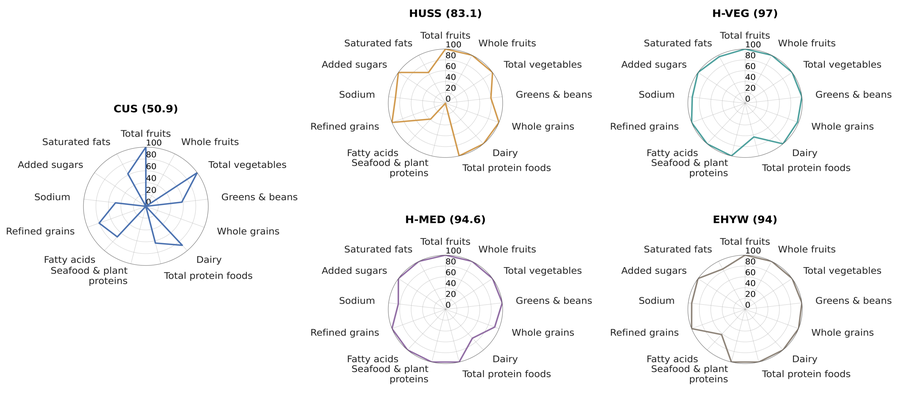

Figure 3: Nutritional impact results of five dietary patterns

Results & Discussion

Integrated Assessment

- Integrated results showed **EHYW diet** and **H-VEG diet** as the most sustainable diets.
- Compared to individually assessing environmental and nutritional impacts, integrated assessment provides a balanced view of environmental and nutrition quality.

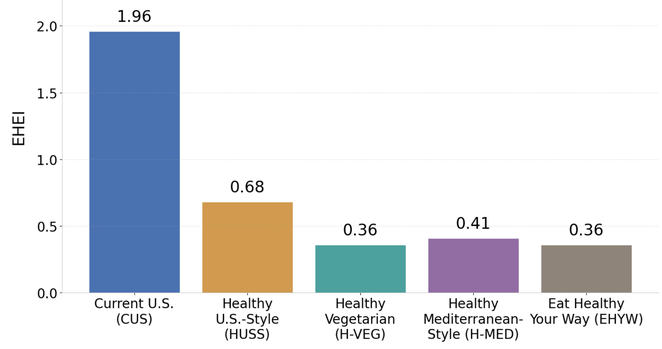

Figure 4: Integrated impact results of five dietary patterns

Conclusion

- Shifting from Current U.S. diet to the recommended diets provides **co-benefits**, reducing environmental burdens while improving nutritional quality.
- **Even small changes in diet,** such as switching protein source and selecting less processed foods, can contribute meaningfully to sustainability.

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