



DISENTANGLING COMPLEXITY: THE APPLICATION OF BAYESIAN NETWORKS TO IDENTIFY JOINT PREDICTORS OF DIET-RELATED GREENHOUSE GAS EMISSIONS AMONG ADULTS IN THE NUTRIQUÉBEC PROJECT

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Background: The health of humans and the planet are closely interconnected and shifting population dietary habits to a more sustainable dietary pattern would have dual benefits. However, many known and unknown factors contribute to whether someone consumes a sustainable diet, making it challenging to implement interventions that will effectively improve dietary sustainability. Bayesian networks, a form of artificial intelligence that combine expert knowledge with structure-learning algorithms, could disentangle this complexity.

Aims: The objective of this project was to identify the most important predictors of diet-related greenhouse gas emissions using Bayesian network analysis.

Methods: Data were drawn from the NutriQuébec project, which included adults in the province of Québec, Canada (n=6620). Participants provided information about their dietary habits (up to three 24-hour dietary recalls), health, and sociodemographic characteristics. Diet-related greenhouse gas emissions (GHGE) (kg of CO₂-eq per kg of foods or beverages) were linked with 24-hour dietary recalls. Hill-climbing algorithms were applied to identify Bayesian networks. Predictors of diet-related GHGE were based on 10 characteristics, including self-reported health, income, and education.

Results: The primary predictors of lower diet-related GHGE after 200 bootstrapped replicates included following a plant-based diet, living in a food secure household and higher educational attainment. The network also identified secondary predictors, like age and region of residence, which informed whether someone followed a plant-based diet, educational attainment, and food security status.

Conclusions: Shifting current food intakes to diets that are healthier and more sustainable is urgent. This research suggests that following a plant-based diet, higher educational attainment, and living in a food secure household are key predictors of lower diet-related GHGE among a network of interconnected characteristics. This research provides needed insights to implement targeted interventions that will improve sustainable eating and by extension, human and planetary health.

Keywords: sustainable eating; diet-related greenhouse gas emissions; Bayesian Networks