Traditional Foods Consumption: Risk Management and Nutritional Value

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Images Source: First Nations Food, Nutrition & Environment Study, 2025

Presentation Overview

- **Introduction to Health Impact Assessment (HIA)**
  - Wholistic interpretation of health
  - Evaluation of both risks and benefits
- **Traditional Foods in Human Health Risk Assessments**
- **Nutritional Benefits of Traditional Foods**
  - Traditional Foods vs. Market Foods Nutrition
  - “Nutrition Quotients”
- **Implications for Mitigation & Remediation**

Image Source: First Nations Food, Nutrition & Environment Study, 2025

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Education:

- Undergraduate degree (Western University)
- Masters in Environmental Health Science (University of Toronto)
- Ph.D. in Health Impact Assessment (University of Toronto)
  - Thesis: “Development and Application of Strategies for Health Impact Assessment of Projects and Policies”

Experience:

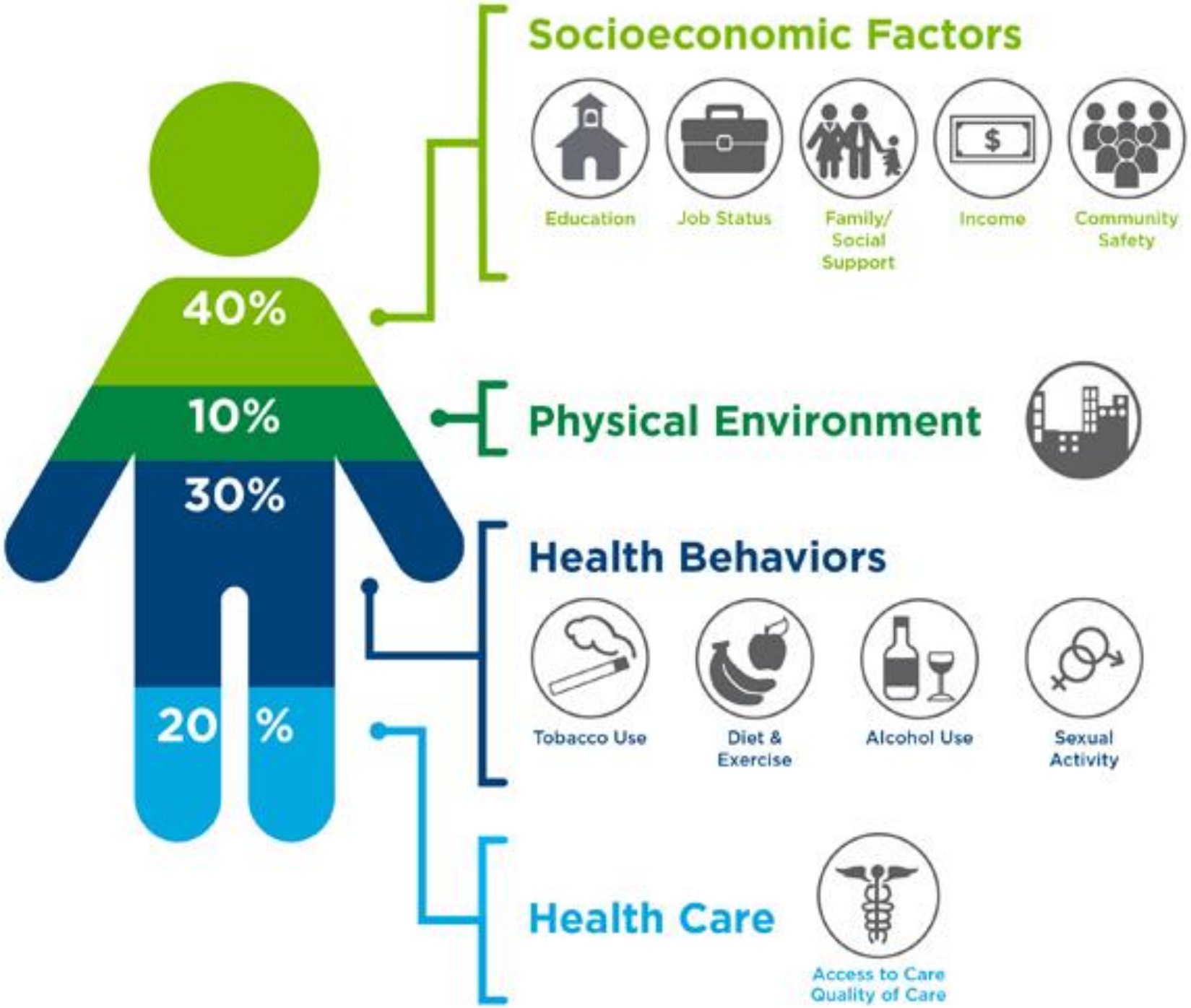
- Senior Principal, HIA at WSP Canada Inc.
- More than 15 years of private and public sector experience
- Worked on HIAs, HHERAs, EA/IA, Public Engagement, Indigenous Health
- Member of an expert panel on Health Impact Assessment for the United Nations
- IAIA Conference Speaker (Bologna, Montreal, Vina del Mare, Florence)

About Me:

- Certified scuba diver – yoga instructor – travel enthusiast (56 countries so far!)

INTRODUCTION TO HEALTH IMPACT ASSESSMENT (HIA)

What Determines Health and Wellbeing?



Source: Institute for clinical systems improvement, going beyond clinical walls (October, 2014)

What Is Health Impact Assessment (HIA)?

“Health Impact Assessment (HIA) is a practical approach used to judge the potential health effects of a policy, programme or project on a population, particularly on vulnerable or disadvantaged groups. Recommendations are produced for decision-makers and stakeholders, with the aim of maximising the proposal's positive health effects and minimising its negative health effects. The approach can be applied in diverse economic sectors and uses quantitative, qualitative and participatory techniques.” (WHO, 2024)

- **HIA looks at health in terms of:**
  - Physical/bio-physical health
  - Social / cultural determinants
  - Mental health / psycho-social well-being
  - Economic determinants
  - Equity focused - considers impacts on various populations, including vulnerable groups and Indigenous Peoples.

Regulatory Context

On August 28, 2019, the *Impact Assessment Act* (the *Act*) came into force, repealing the *Canadian Environmental Assessment Act (CEAA)*, 2012.

Under the *Act*, impact assessments (IAs) of proposed resource and infrastructure development projects designated under the associated regulations are now required to consider the environmental effects, as well as the broader social, economic and health implications, both positive and negative, of project-related components and activities.

As a result, IAs are expected to study health effects as they relate to environmental, social, and economic conditions, and their interactions. IAs can be conducted on a project-basis or via strategic and regional assessments.

HIA is a systematic, objective, and specialized process that can be used to assess the potentially positive and adverse effects of a designated project on well-being and health. It also highlights ways to maximize positive effects and minimize adverse effects on health.

HIA by Sector

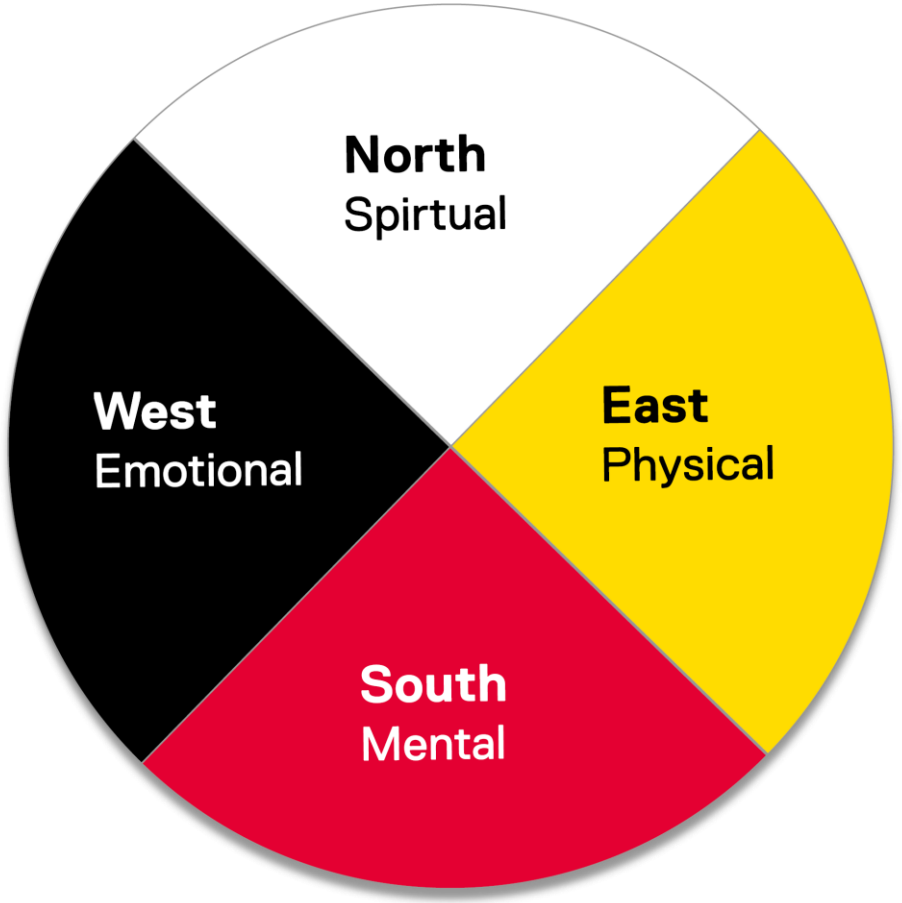
For each of these sectors, the opportunities to apply HIA to projects of varying size and complexity exist both within and outside of regulatory processes world-wide. The use of HIA in these sectors would be a novel approach as an alternative to, or complimentary to, HHRA.

Mining	**Oil & Gas**	**Transportation**
Energy & Renewables	**Waste Management & Landfills**	**Government (municipal, provincial, federal)**
Buildings / Development	**Public Health**	**Climate Change & Resilience**

Indigenous Health

Indigenous understandings of health may involve inter-related physical, emotional, mental and spiritual domains, as well as the appreciation of a sacred relationship with the land.

Indigenous Peoples' views of health may be based in "*Indigenous ways of knowing and being, including concepts of spirituality, connectedness and reciprocity to the land and all life, self-reliance, and self-determination*".



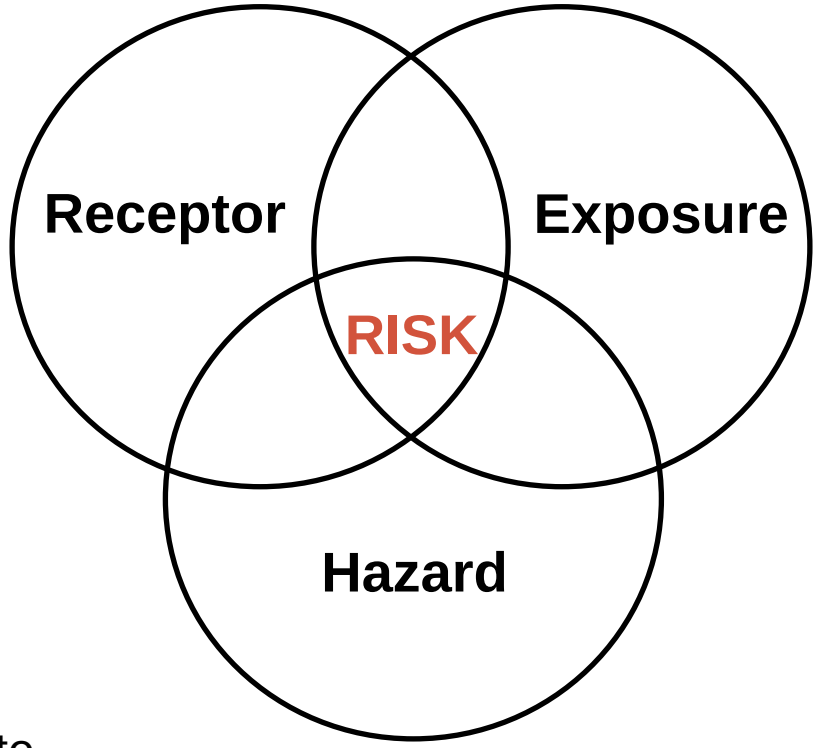
Gender Based Analysis Plus (GBA+)

HIA practice aligns well with GBA+ in practice and can meet GBA+ requirements in IA

- **Gender-based Analysis Plus (GBA Plus)** is an analytical tool used to support the development of responsive and inclusive policies, programs, and other initiatives.
- GBA Plus is an intersectional analysis that goes beyond biological (sex) and socio-cultural (gender) differences to consider other factors, such as age, disability, education, ethnicity, economic status, geography (including rurality), language, race, religion, and sexual orientation.
- HIA best-practice focuses not only on understanding human health effects but also looking at the distribution of those effects across a population.
- This approach aligns well with GBA+ in that HIA allows for additional analysis to understand whether effects are experienced differently by different sub-groups.

Typical Assessment of Traditional Foods in Human Health Risk Assessment

Human Health Risk Assessment (HHRA)



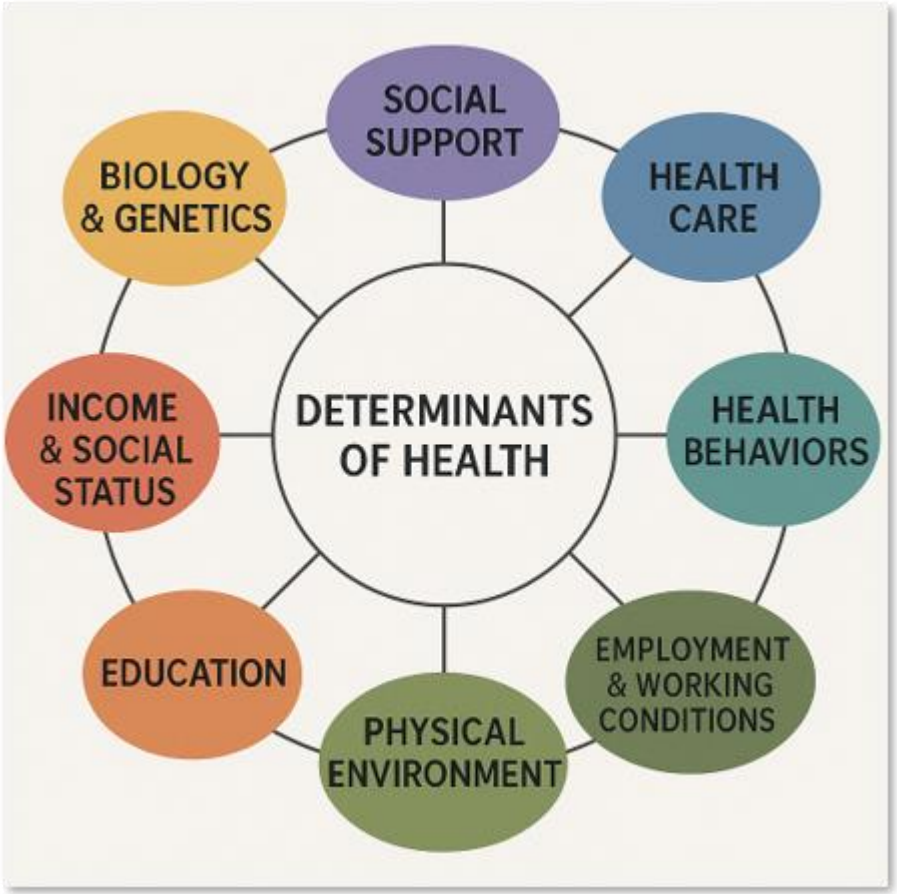
- A tool used to estimate the magnitude of potential adverse effects to human resulting from exposure to environmental impacts.
- Focuses on most sensitive receptors and driving exposure pathways at a site, excluding community approach
- Quantifies potential hazards and identifies the consequences of those hazards with respect to **adverse health effects**
- Develops risk management measures as required

Human Health Risk Assessment (HHRA)

- Traditional foods typically evaluated via HHRA in large-scale Environmental Assessment (EA) and Impact Assessment (IA) projects, and can be included in due-diligence HHRA's
- Includes: Problem Formulation, Hazard Assessment, Toxicity Assessment, Risk Characterization
  - Evaluation of human health risks from consumption of traditional foods from possible contaminants (metals, polychlorinated biphenyls [PCBs], per- and poly-fluoroalkyl substances [PFAS])
- If risks are identified through calculation of hazard quotients (HQ) and incremental lifetime cancer risks (ILCR), risk management measures can include consumption advisories to limit exposure

HHRA & Health Impact Assessment (HIA)

- Both HHRA and HIA assess the potential for projects to impact human health.
  - HHRA falls under the ‘umbrella’ of HIA since HIA considers the full range of 'determinants' of health:
    - Biophysical
    - Sensory stressors (noise, light, etc.)
    - Socio-economic
    - Cultural
- HIA extends beyond HHRA by looking not only at the negative biophysical effects from chemical exposure, but potential positive benefits for human health from project activities.



BENEFITS OF TRADITIONAL FOOD CONSUMPTION

Intangible Benefits of Traditional Foods

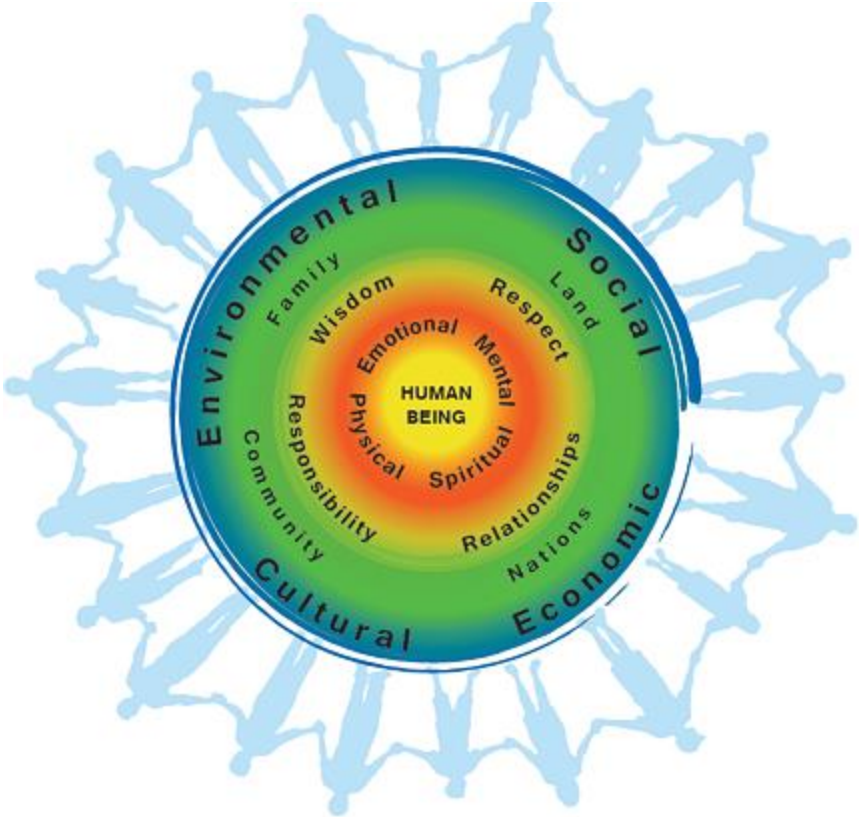
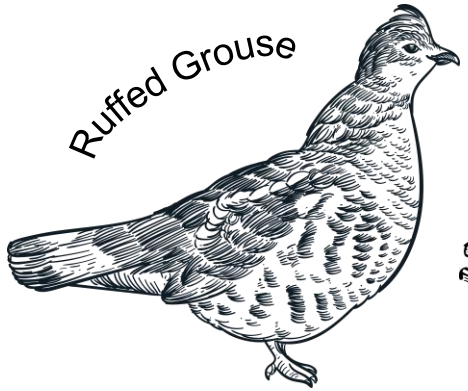


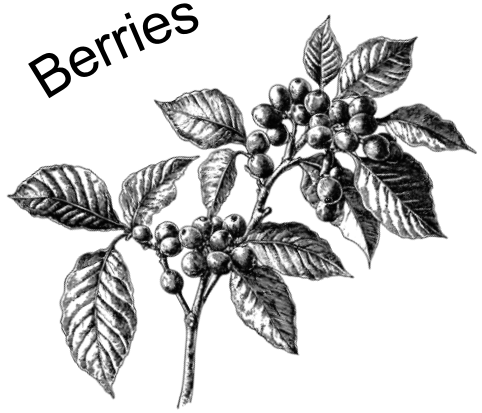
Image Source: FNHA, 2025

Image Source – NCCIH, 2022

Quantifiable Benefits of Traditional Foods

- Traditional food diets contain high levels of essential nutrients[1,2].
- Polyunsaturated fatty acids (PUFA), such as omega-3 fatty (DHA, EPA) from fish and fish oils promote greater cardiovascular health[2,3,4].
- Traditional food diets have been shown to improve health status for vitamins (i.e., A and D) and nutrients such as iron, magnesium, protein, and folic acid, and to reduce the rates of diabetes, obesity and other diet-related diseases[4,5,6]
- Nutrition profiles of traditional foods often contain macro- and mirconutrients far and above commercial food sources[2,3,4,7].
- *Note: these are the known health benefits as identified by western science and do not account for other well-being and cultural benefits*





All images from iStock, 2025

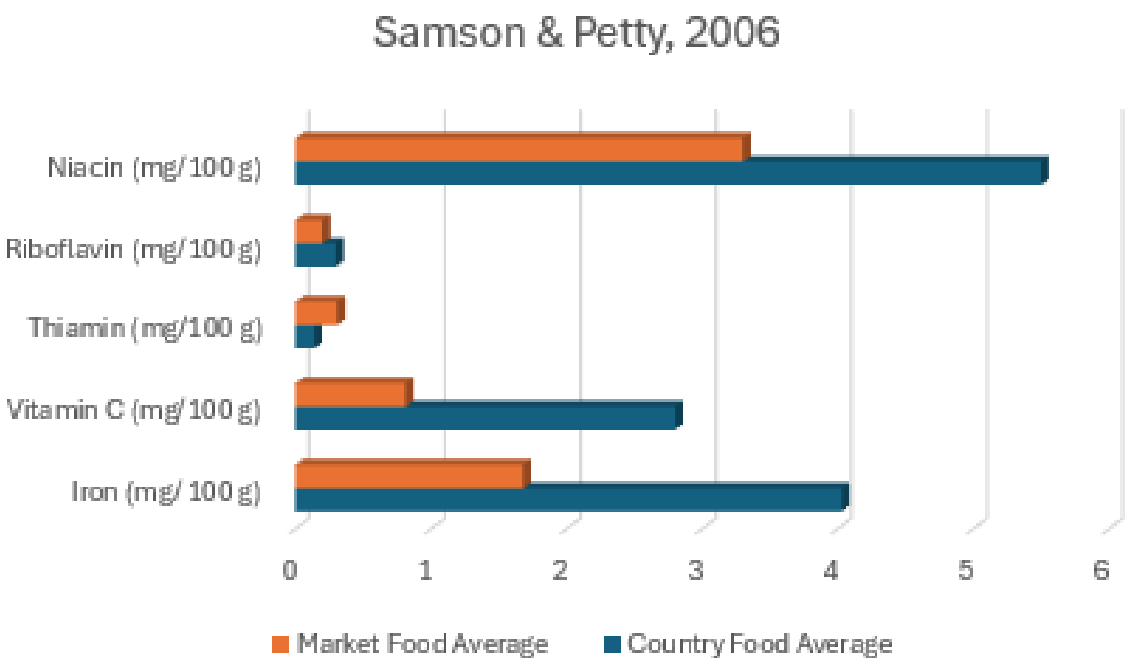
Quantifiable Benefits of Traditional Foods

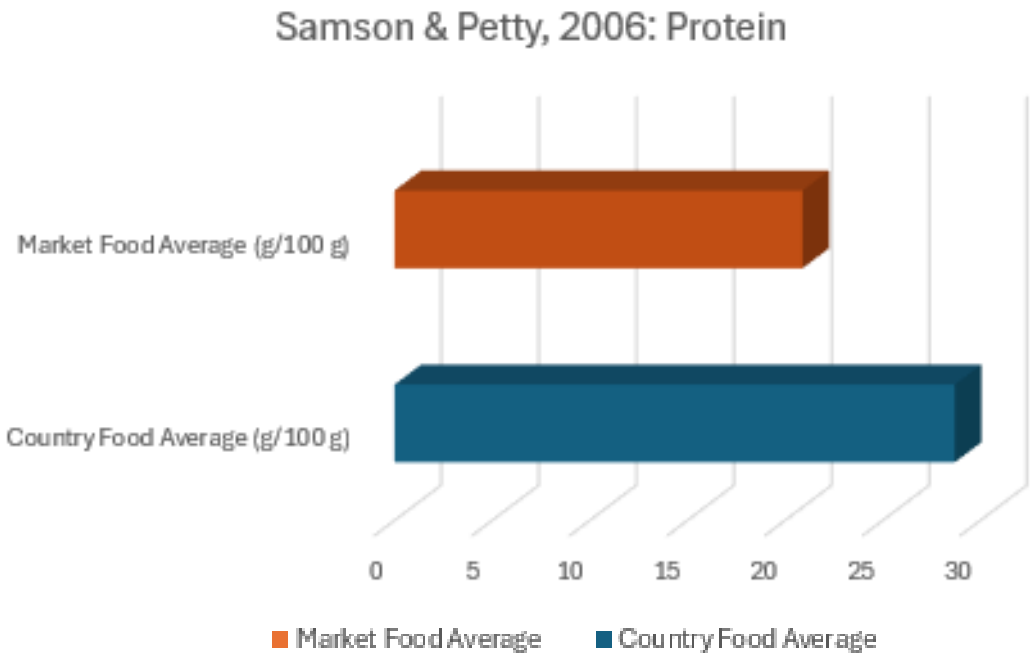
Table 1. Nutrient content for wild and store foods (USDA National Nutrient Database 2003, Gebhardt and Thomas 2002)

Food	Energy (MJ $100g^{-1}$)	Protein (g $100g^{-1}$)	Total fat (g $100g^{-1}$)	Satur-ated fat (g $100g^{-1}$)[1]	Iron (mg $100g^{-1}$)	Vitamin C (mg $100g^{-1}$)	Thiamin (mg $100g^{-1}$)	Ribo-flavin (mg $100g^{-1}$)	Niacin (mg $100g^{-1}$)
Caribou	0.69	29.8	4.42	1.7	6.17	3	0.25	0.9	5.8
Pheasant	1.03	32.4	12.1	3.5	1.43	2.3	0.07	0.18	7.5
Beaver	0.89	34.9	6.96	2.1	10.0	3	0.05	0.31	2.2
Rabbit (wild)	0.72	33.0	3.51	1.1	4.85	0	0.02	0.07	6.4
Moose	0.56	29.3	0.97	0.29	4.22	5	0.05	0.34	5.3
Duck	0.51	19.9	4.25	1.32	4.51	6.2	0.42	0.31	3.4
Salmon	0.77	27.4	7.50	1.59	0.71	1	0.12	0.16	7.8
Trout	0.63	22.9	5.80	1.52	0.38	2	0.15	0.09	5.8
Average for country foods	0.72	28.7	5.69	1.64	4.03	2.8	0.14	0.30	5.5
Luncheon meat	1.40	12.5	30.3	10.8	0.72	1	0.37	0.19	3.1
Bologna beef/pork	1.27	15.2	24.6	9.7	1.21	0.8	0.22	0.19	2.5
Pork loin chops	1.03	27.9	14.5	5.3	1.05	0.9	0.77	0.22	4.6
Beef, braised	1.43	26.9	25.7	10.2	3.04	0	0.07	0.23	2.5
Steak	1.07	28.0	15.2	6.1	3.04	0	0.10	0.27	3.9
Beef corned	1.04	26.9	15.2	6.2	2.10	0	0.02	0.14	2.4
Beef/pork frankfurter	1.34	11.1	28.9	10.7	1.10	0	0.20	0.11	2.7
Pork sausage	1.54	19.2	30.8	10.8	1.15	3.8	0.73	0.27	4.6
Average for store foods	1.26	20.9	23.2	8.7	1.68	0.81	0.31	0.20	3.3

Samson, C., & Pretty, J. (2006).

Quantifiable Benefits of Traditional Foods





- Traditional foods, on average, had higher content of niacin, riboflavin, Vitamin C, iron and protein than market foods.

Quantifiable Benefits of Traditional Foods

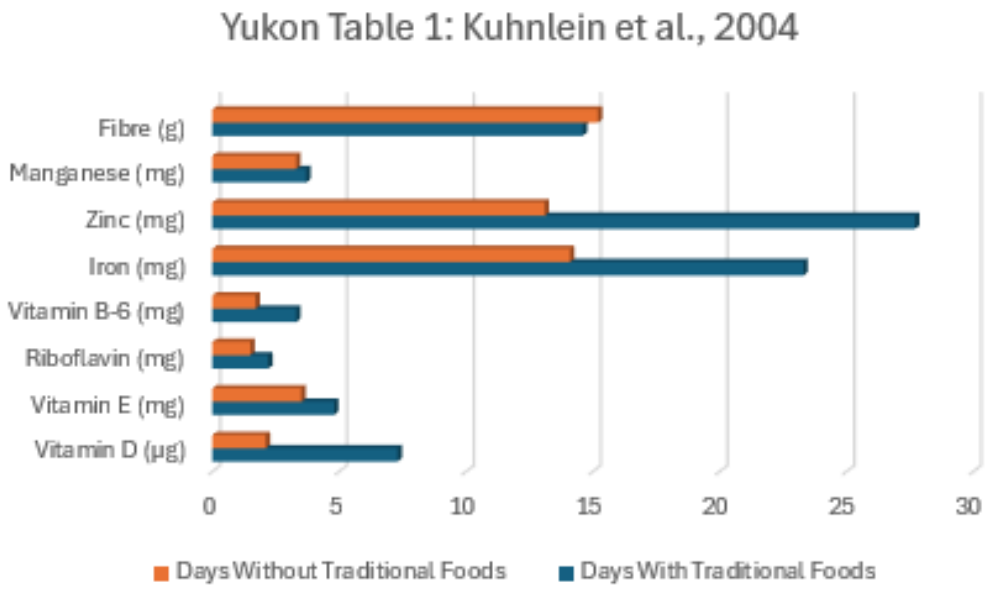
Micronutrient, fiber, and energy intake on days with and without traditional food (TF) for Yukon, Dene/Métis, and Inuit adults[1]

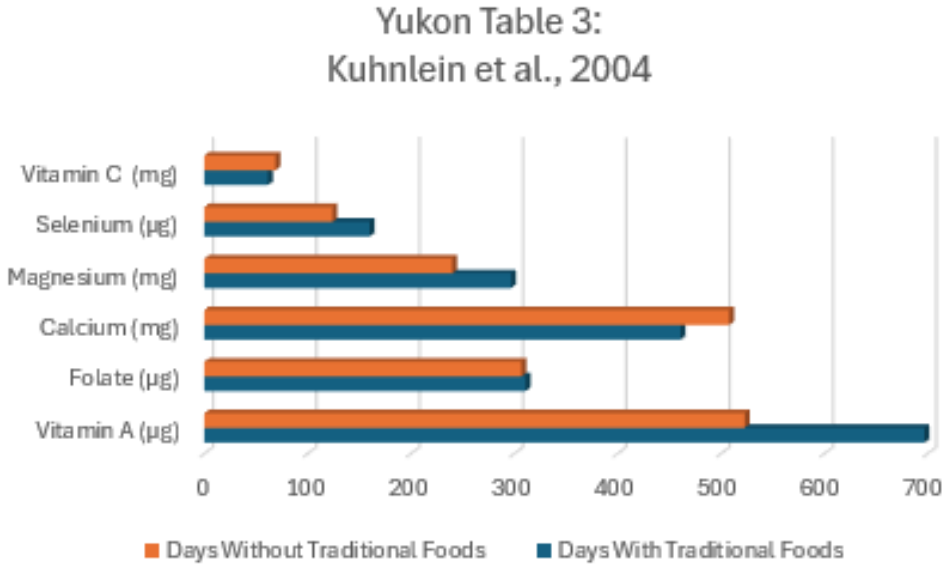
	Yukon		Dene/Métis		Inuit	
Nutrient	Days with TF (n = 410)	Days without TF (n = 387)	Days with TF (n = 661)	Days without TF (n = 346)	Days with TF (n = 968)	Days without TF (n = 632)
Vitamin A,[2] *μg RAE*	697 ± 45	523 ± 52	1245 ± 424	825 ± 578	911 ± 136[a]	433 ± 179[b]
Vitamin D, *μg*	7.3 ± 0.6[a]	2.1 ± 0.7[b]	7.9 ± 0.9[a]	3.5 ± 1.3[b]	25.1 ± 1.3[a]	8.6 ± 1.7[b]
Vitamin E, *mg*	4.8 ± 0.1[a]	3.5 ± 0.2[b]	6.5 ± 0.4[a]	3.9 ± 0.5[b]	5.4 ± 0.2[a]	3.1 ± 0.3[b]
Vitamin C, *mg*	61.8 ± 5.2	68.9 ± 5.9	52.6 ± 4.3	60.9 ± 5.9	62.1 ± 3.4[a]	70.6 ± 4.5[b]
Riboflavin, *mg*	2.2 ± 0.1[a]	1.5 ± 0.1[b]	2.5 ± 0.1[a]	1.6 ± 0.1[b]	2.9 ± 0.1[a]	1.3 ± 0.1[b]
Vitamin B-6, *mg*	3.3 ± 0.1[a]	1.7 ± 0.1[b]	3.7 ± 0.1[a]	1.9 ± 0.1[b]	4.0 ± 0.1[a]	1.4 ± 0.1[b]
Folate, *μg DFE*	311 ± 9	307 ± 11	303 ± 10	316 ± 14	317 ± 10[a]	319 ± 13[b]
Calcium, *mg*	461 ± 20	508 ± 23	533 ± 17	526 ± 24	443 ± 12	451 ± 16
Iron, *mg*	23.3 ± 0.6[a]	14.1 ± 0.7[b]	26.5 ± 0.9[a]	15.6 ± 1.3[b]	37.4 ± 1.1[a]	15.0 ± 1.4[b]
Zinc, *mg*	27.7 ± 0.9[a]	13.1 ± 1.1[b]	23.8 ± 1.0[a]	15.4 ± 1.3[b]	21.5 ± 0.5[a]	9.5 ± 0.6[b]
Copper, *μg*	1655 ± 46[a]	1163 ± 53[b]	2025 ± 89[a]	1439 ± 122[b]	2076 ± 44[a]	1041 ± 58[b]
Magnesium, *mg*	297 ± 6[a]	240 ± 7[b]	305 ± 5[a]	237 ± 7[b]	597 ± 31[a]	280 ± 40[b]
Manganese, *mg*	3.7 ± 0.1[a]	3.3 ± 0.1[b]	3.6 ± 0.1[a]	3.3 ± 0.1[b]	3.3 ± 0.1[a]	2.7 ± 0.1[b]
Phosphorus, *mg*	1602 ± 35[a]	1155 ± 40[b]	1759 ± 31[a]	1224 ± 43[b]	1663 ± 27[a]	947 ± 36[b]
Sodium, *mg*	2334 ± 89[a]	2692 ± 102[b]	2544 ± 80[a]	3050 ± 109[b]	2199 ± 73[a]	2437 ± 95[b]
Potassium, *mg*	3520 ± 76[a]	2608 ± 87[b]	3516 ± 63[a]	2561 ± 86[b]	2997 ± 53[a]	1999 ± 70[b]
Selenium, *μg*	160 ± 4[a]	124 ± 5[b]	151 ± 3[a]	132 ± 5[b]	195 ± 10[a]	107 ± 13[b]
Dietary fiber, *g*	14.6 ± 0.4	15.2 ± 0.5	12.6 ± 0.3	12.9 ± 0.4	9.7 ± 0.3[a]	11.2 ± 0.4[b]
Total energy, *kJ*	8735 ± 193	1971 ± 221	9677 ± 173	8759 ± 236	8577 ± 149[a]	7456 ± 196[b]

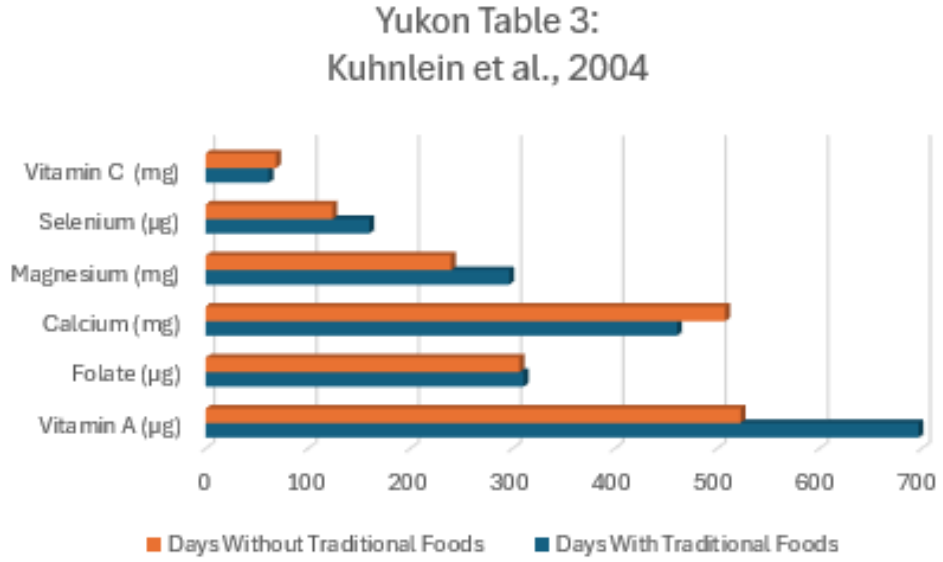
[1] Values are LSM ± SEM (Kruskal-Wallis nonparametric ANOVA within each cultural area adjusted for food source, age, gender, season, site, and day of week): means in a row with superscripts without a common letter differ, $P < 0.01$.
[2] RAE, retinol activity equivalents; DFE, dietary folate equivalents.

Kuhnlein et al. (2004).

Quantifiable Benefits of Traditional Foods







- On days when traditional foods were ingested, intakes of manganese, zinc, iron, potassium, phosphorus, selenium, magnesium, riboflavin, folate, Vitamin E, Vitamin D, Vitamin B-6, and Vitamin A were higher.
- In particular, intakes of zinc, iron, Vitamin A and energy were significantly higher on days with traditional foods.

Risk vs. Health Benefit Calculations

Hazard Quotient (HQ)

- HQ = Dose / Toxicity Reference Value

Incremental Lifetime Cancer Risk (ILCR)

- ILCR = Lifetime Average Daily Dose x Cancer Slope Factor

Nutritional Quotient (NQ)

- NQ = Dose / Recommended Daily Intake Value

- TRVs replaced with Health Canada (2025) Recommended Dietary Allowances (RDA) values
- ‘Dose’ taken from Canadian Nutrient Files (Health Canada, 2025)
  - Review of available literature found agreement between nutritional value findings from studies and CNF reported values, where available.
- Consumption rates of mammals, birds, organ meat, berries and leaves adopted from FNFNES (Chan et al., 2016)

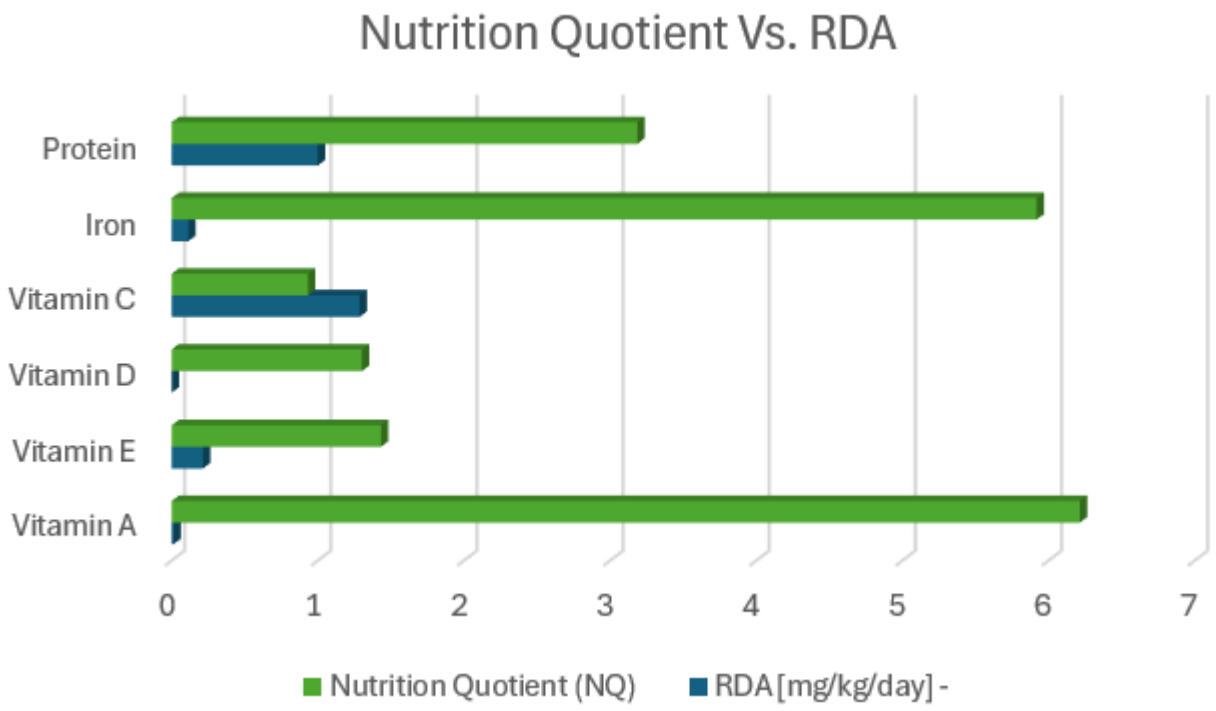
NQ : Nutritional Quotient

	Arsenic	Cadmium	Lead	Mercury	Risk Benchmark
HQ	-	**3.70E+01**	**1.42E+01**	**5.51E+00**	1
ILCR	**3.99E-04**	-	-	-	1.00E-05
	Bold = Exceedance of Risk Benchmark				

- Using concentrations measured in common traditional foods and applying standard risk assessment approaches, risks above regulatory benchmarks are commonly calculated.
- The example presented above was calculated using publicly available metals data from an EA in Alberta supplemented with data from Chan et al. (2016), TRVs from Health Canada (2021), and consumption rates from Chan et al. (2016). An assumed body weight of 70 kg and an assumed total traditional food intake of approximately 1 kg/day of traditional foods was applied for the calculations.
- Using the same traditional foods, consumption rate, food intake and body weight assumptions, a **‘nutritional quotient’** was calculated using Health Canada Recommended Dietary Allowances (RDA) and nutrition data from the Canadian Nutrient Files.
- Calculations indicate the same traditional foods provide macro- and micronutrient data exceeding recommended daily intake values

	Vitamin A	Vitamin E	Vitamin D	Vitamin C	Calcium	DHA + EPA	Protein	Iron
Nutrition Quotient (NQ)	**6.21E+00**	**1.43E+00**	**1.30E+00**	9.33E-01	**1.81E-01**	**1.59E-02**	**3.19E+00**	**5.92E+00**
	Bold = Nutrient quantity provided by traditional food above total recommended daily value							

NQ : Nutritional Quotient



- Based on calculation, traditional foods provided approximately:
  - **6x** required daily amount of iron and Vitamin A
  - **3x** required daily amount of protein
  - **1.5x** required daily amount of Vitamin D and E
  - **Almost all** required daily amount of Vitamin C

Key Consideration: There is currently no prescribed method to complete a quantitative comparative analysis the risks against the nutritional benefits of traditional food consumption; however, recognition of health benefits is of particular importance for Indigenous groups as it related to perceptions of food safety.

IMPLICATIONS FOR MITIGATION & REMEDIATON

Mitigation & Remediation Implications

- **NQ Provides Additional Context:** Consideration of nutritional benefits of traditional food consumption has implications for risk characterization results and subsequent recommended risk remediation measures
- **Need for Data:** Collection of nutrient levels and additional analysis of nutritional parameters in Traditional foods baseline studies
- **Inform Consumption Advisories:** Potential to eliminate the need for, or to lessen the extent of, food consumption advisories based on findings and comparative analysis (in development)
- **Inform Monitoring Programs:** Country foods monitoring programs should include assessment of nutritional profile of traditional foods to allow for presentation of both risks and benefits

Mitigation & Remediation Implications

- **HIA Highlights Benefits:** Using HIA brings project benefits into the narrative for human health; balance of enhancing positives while mitigating negatives
- **HHRA & HIA Approach:** Application of both HHRA and HIA methodologies promotes a fulsome assessment of human health and well-being
  - Often includes communities and their advisors in decision-making around remedial measures; enhances buy-in of approaches and recommendations
- **Food Security (and Food Sovereignty):** Cited as a major concern of Indigenous communities across Canada
  - By providing a more fulsome approach to assessing this aspect, fosters collaboration, trust-building and promotes remedial plans that are more sensitive to food safety.

THANK YOU

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