

Benefits and Risks Revisited

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Inuit Circumpolar Conference



Inuit Tapiriit Kanatami



Métis Nation (NWT)



Mohawk Council of Kahnawake

Yukon, Dene/Métis and Inuit Research Communities



Nutrient Intake on Days With or Without Traditional Food (TF) (least square means \pm SEM)

		With TF	N	Without TF	N
Total energy (Kcal)	Yukon	2052 \pm 45 *	413	1947 \pm 52	389
	Dene/Métis	2261 \pm 39 *	662	2085 \pm 55	350
	Inuit	2170 \pm 35 *	1092	1857 \pm 41	783
As % Energy Carbohydrate	Yukon	37 \pm 0.6		42 \pm 0.7 *	
	Dene/Métis	36 \pm 1		42 \pm 1 *	
	Inuit	37 \pm 0.5		49 \pm 0.6 *	
Protein	Yukon	32 \pm 0.5 *		19 \pm 0.5	
	Dene/Métis	31 \pm 0.4 *		20 \pm 0.6	
	Inuit	33 \pm 0.4 *		17 \pm 0.5	
Fat	Yukon	30 \pm 0.6		40 \pm 0.5 *	
	Dene/Métis	31 \pm 1		37 \pm 1 *	
	Inuit	32 \pm 0.5		38 \pm 0.6 *	

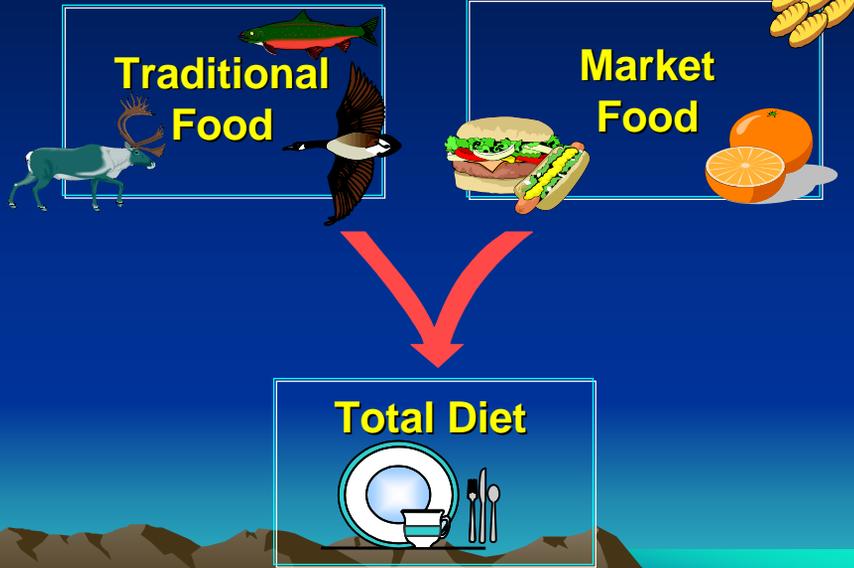
* significant $p < 0.05$ (adjusted for season, site, gender, age)

Dietary Nutrients in Days With or Without Traditional Food (TF) (least square means \pm SEM)

		With TF	Without TF
Protein, % energy	Yukon	32 \pm 0.6*	18 \pm 0.3
	DeneMétis	30 \pm 1*	19 \pm 1
	Inuit	32 \pm 0.4*	16 \pm 0.5
Iron, mg	Yukon	25 \pm 1*	13 \pm 1
	DeneMétis	25 \pm 1*	15 \pm 2
	Inuit	36 \pm 2*	11 \pm 2
Zinc, mg	Yukon	28 \pm 1*	12 \pm 1
	DeneMétis	25 \pm 1*	15 \pm 1
	Inuit	22 \pm 0.7*	9 \pm 0.7
Vit. A, RE	Yukon	500 (430, 582)	462 (395, 540)
	DeneMétis	304 (258, 358)	321 (254, 405)
	Inuit	438 (378, 507)*	301 (262, 346)

* significantly greater at $p \# 0.05$

Balancing Dietary Benefits and Risks



Sahtú Dene,
Northwest Territories





INUIALUIT



Benefits of Fish Consumption Advisories:

- **Reduction in MeHg exposures and risks associated with MeHg;**
 - **MeHg is an established neurotoxin;**
 - **To want to eliminate exposures even in the presence of conflicting evidence of low-level effects is understandable;**
- **Is there a move toward zero tolerance in the future?**

Could a fish consumption advisory be contraindicated by community factors?

1. **What is the extent and nature of food security in the community?**
 - **Local Availability of Market Food;
Quality, Diversity, Costs**
 - **Household income, household size, and food purchasing power;**
 - **Alternative food choices and meal composition;**
 - **Culturally acceptable food choices.**

Could a fish consumption advisory be contraindicated by community factors?

- 2. What are the leading public health issues they face?**
- 3. What other exposures are contributing to cognitive impairment in the community? What is the prevalence and severity of these factors?**

Guidelines for Evaluating Benefits and Risks of Fish Consumption Advisories

- 4. What will be the impact on food security and composition of the diet?**
- 5. Would the anticipated dietary composition changes be beneficial in light of the public health challenges faced by the community?**

Fish and Omega-3 Content (Source: USDA)

Fish Species	EPA + DHA g/3 oz.	Oz. for 1 g of EPA/DHA *
Herring -Pacific	1.8	1.5
Salmon		
Atlantic Farmed	1.1-1.8	1.5 - 2.5
Atlantic Wild	0.9-1.6	2.0 - 3.5
Chinook	1.5	2.0
Rainbow Trout -Wild	0.8	3.5
Farmed	1.0	3.0
Tuna -White canned	0.7	4.0
Light canned	0.3	12.0
Fresh	0.2 - 1.3	2.5 - 12.0
Cod -Atlantic	0.2	12.5

*long-chain *n*-3 fatty acids

EPA = eicosapentaenoic acid, DHA=docosahexaenoic acid

Current status on Fish Intake and ...

- **Cancer**
- **Diabetes**
- **Heart Disease**

Breast Cancer and Fish Intake

■ Singapore Chinese Health Study

- Prospective Study of 35, 298 women and breast cancer incidence;
- 45-74 yrs and enrolled 1993-1998 (followed through 2000);
- Fish and shellfish protective; 26% reduction for top 3 quartiles of intake relative to lowest quartile;
- Among those in the lowest quartile of fish intake, high n-6 intake elevated risk relative to low n-6 intake (RR =1.87, 95% CI1.06-3.27).
- Fish/shellfish intake by quartiles: 24.5, 44.2, 58.3, 80.5 g/day.

Gago-Dominquez et. al. *British Journal of Cancer* 2004; 89: 1686-1692.

Fish Intake and Breast Cancer

- 6 Cohort Studies on fish intake;
 - Norway –NS inverse relationship poached meals (Vatten et al, 1990);
 - Japan – ≥ 5 servings of dried fish associated with a 50% lower risk compared to ≤ 1 serving, $p < .05$.
(Key et al, 1999)
 - US –No significant findings (Stampfer et al, 1987; Toniolo et al 1994; Gertig et al, 1999; Holmes et al, 1999);
 - Only 15% of US women consume > 1 fish serving/week – NHANES I (Gillum et al, 1996).

Endometrial Cancer and Fish Intake

- Swedish Case-Control Study of 1,055 Cases and 4216 Controls; of which 75% and 80% participated;
- Fatty fish consumption inversely related with endometrial cancer;
- Highest quartile of fatty fish intake (median of 2 servings/week) vs. lowest quartile of intake (median 0.2 servings/week) –OR =0.6 (95% CI=0.5-0.8);
- A 40% reduction after adjusting for multiple risk factors.

Terry et. al., *Cancer Epidemiology, Biomarkers and Prevention* 2002;11:143-145.

Prostate Cancer and Fish Intake

- Health Professionals' Follow-up Study;
- Inverse association of total fish intake and marine fish intake with metastatic prostate cancer;
- > 3 servings/week compared with infrequent fish consumption, OR=0.5 (0.3 – 0.8);

Augustsson et al, *Am J Epidemiology* 2001;153:S31 (abstract).

Diabetes and Fish Consumption Advisories

Northern Perspectives from Indigenous Communities:

- Community folks --perceive a link between fish consumption advisories and diabetes;
- Direct or indirect link?
- Any plausible mechanism for an effect on diabetes?
 - decreases in physical activity;
 - increase in alternative food sources high in *trans*-fatty acids, saturated fat;
 - decreases in omega-3 fatty acids and high protein diet;
 - weight gain.

Fish Intake and Type 2 Diabetes Mellitus Prevention

Animal Studies:

- Saturated fat worsens insulin sensitivity;
- *n*-3 fatty acids in muscle cell membrane phospholipids strongly and positively correlated with insulin sensitivity;
- *n*-3 fatty acids improve insulin action and counteracts negative effects of saturated fat (Storlein 1991).

Fish Intake and Diabetes Prevention

Four - Year Prospective Trial:

- **Cumulative incidence of abnormal glucose tolerance in 175 elderly normoglycemic 64-87 year olds;**
- **25% incidence in habitual fish consumers;**
- **45% incidence in non-fish consumers;**

Feskens et al, *Diabetes Care* 1991; 14:935-941

Fish Intake and Diabetes Prevention

20-year prospective trial:

- **Finnish and Dutch Cohorts of the Seven Countries Study – men only;**
- **Baseline and recent fish consumption were inversely related to 2-hour glucose level ($p < .05$);**
- **High intake of total fat and saturated fat increased risk of NIDDM and glucose tolerance;**
- **Vitamin C, legumes, vegetables and potatoes also inversely related.**

Feskens et al., *Diabetes Care* 1995; 18:1104-1110.

Fish Intake and Diabetes Prevention

- Nurses Health Study -US
 - 84,204 women;
 - 14-year follow-up
 - *Trans* fatty acids associated with increased risk;
 - Highest 5th quintile of *n*-3 intake protective, RR= 0.8 (95% CI=0.67-0.95);

Salmeron et al, *Am J Clin Nutr* 2001;73:1019-26.

Fish Intake and Coronary Heart Disease Mortality Among Diabetics

Nurses' Health Study

- 5,103 female nurses with type 2 diabetes mellitus but free of cardiovascular disease or cancer at baseline (1980 baseline);
- Follow-up in 1996 (45,845 person-years of follow-up);
- Fish Intake
 - ≥ 5 times/week RR =0.36 (95% CI=0.2-0.66)
 - 2-4 times/week RR =0.64 (95% CI=0.42-0.99)
 - 1-3 times/week RR =0.60 (95% CI=0.42-0.85)

Hu et. al. Circulation 2003;107:1852-1857.

Diabetes and Pregnancy

- Gestational Diabetes -Risk factors –not as extensively studied;
- Risk factors similar to type 2 DM;
- Profound impact on many indigenous communities;
- Background Rate for U.S. and Canadian Populations = 3%;
- $\geq 18\%$ in many indigenous communities.

Pregnancy, Diabetes, and Offspring's Risks

- Increased risk for obesity at an early age and early onset type 2 diabetes mellitus:
- 4 times more likely to be above 90th %ile for weight for age;
- Higher birth weight –can disappear around 1-2 years of age and reappears after age 5;
- By 8 years as great as 50% of offspring of diabetic pregnancies are above the 90th %ile.

Pregnancy, Diabetes, and Offspring's Risks

- **Impairments in Neurodevelopment:**
 - Greater impairments with poorer glycemic control;
 - HbA_{1c} (n=19) strong and significant inverse correlations with Bender ($r = - 0.5$), Bruininks general motor ($r = - 0.4$) and fine motor ($r = - 0.4$).
 - White's classification of glycemic control (n=53) significant and strong inverse correlations with MFP sensory ($r = - 0.3$), LTS sensory ($r = - 0.29$).
 - Omoy et al, 1998;

Pregnancy, Diabetes, and Offspring's Risks

- **Diabetes with good glycemic control:**
 - Neurological impairments now noted;
 - Developing Brain may be sensitive to altered metabolism associated with diabetes;
 - MDI score and PDI score significantly lower in the diabetic group than in the controls (91.04 vs. 98.15 and 85.15 vs. 95.54)
 - MDI=mental development index, psychomotor development index. Hod et al, *J Pediatric Endocrinology & Metabolism* 1999; 12:867-872.

Diabetes: Early Infant Feeding

Method of infant feeding – and risk of glucose tolerance in adults aged 48-53 years (Ravelli et al, 2000):

- **Bottle-fed subjects had a higher mean 2-hour plasma glucose concentration than those exclusively breast-fed;**
- **Breast-fed infants have a higher % of DHA and total LCPUFAs in muscle phospholipids and lower plasma glucose levels compared with the formula-fed infants.**

Fish, Hg and the Heart

- **Heart is one of the target organs for Hg;**
- **Implications heart disease endpoint not understood;**
- **Hg alters cardiac sodium handling;**
- **Evidence that Hg can modify response to viral infections;**
- **Epidemiological Evidence is inconsistent thus far.**

Fish, Hg and the Heart

- **Sweden –two studies -- no adverse effect on risk of first MI;**
- **US Health Professionals –no overall adverse effects –poor power to observe effect in non-dentists;**
- **Finland –adverse effects noted; many of the same endpoints associated with low Se in previous studies in same population;**
- **EURAMIC -8 European Countries and Israel – toenail Hg and non-fatal MI –adverse effects noted –DHA protective;**
- **Minimata—no elevated rate of death from CHD and no elevated risk of arteriosclerosis with high hair Hg levels.**

■ **Public Health Assessment and Environmental Assessments**

■ **Better Partnerships Are Needed**

- **Burden of Chronic Disease is Great – Evidence that fish consumption can play a role in prevention strategies.**