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○アブストラクトデータ

Effects of n-3 polyunsaturated fatty acids and methylmercury in the traditional diet on risk of cardiovascular diseases among Inuit in Arctic Canada

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Background: Inuit have low reported incidence of ischemic heart diseases because of their rich n-3 fatty acids traditional marine diet. They are experiencing rapid nutrition transition and increases in environmental contaminants exposure. The risk of ischemic heart disease is becoming a concern.

Objective: The main objective was to estimate the usual intake of eicosapentaenoic acid (EPA, 20:5n3), docosahexaenoic (DHA, 22:6n3), and methyl mercury (MeHg) and characterize their contributions to the risk of myocardial infarction (MI) among Inuit living in Arctic Canada. We also estimated the effects of adopting a more traditional marine diet on MI risk.

Design: We used data collected from the International Polar Year Inuit Health Survey (IHS) that collected nutrition data from 2072 adult participants in Canada in 2007-9 to estimate the intake of EPA, DHA and MeHg. Their effects on MI risk were estimated using a model with dose-response formulas and assumptions were extracted from various epidemiology studies in the literature.

Results: Inuit in Arctic Canada had higher concentrations of EPA and DHA in red blood cells and MeHg in total blood than the average US and Canadian general populations. Their traditional foods contained an average of 0.3 ug of EPA, 0.28 ug of DHA and 9.7 ug of MeHg per 100 g. Arctic char meat was the best source of EPA and DHA. Ringed seal liver was the major source of MeHg. Estimated daily intakes of EPA, DHA and MeHg were 1.2 g, 1.11 g, and 28.1 ug for men and 0.8 g, 0.74 g and 25.4 MeHg for women. EPA and DHA had a positive and MeHg had a negative effect on the relative risk (RR) of MI. The net effect on RR was 1.054 for men and 1.042 for women indicating the modern traditional food diet intake increased MI risk by 5% and 4% for Inuit men and women respectively. Further increase the intake of selected fish, like salmon, herring and arctic char can reduce MI risk (RR 0.93, 0.96, 0.99) at two servings per week.

Conclusions: In the modern Inuit diet, the beneficial effect on MI of EPA and DHA was lessened by the adverse effect of MeHg. Increase intake of fish with high EPA+DHA to MeHg ratio will help to prevent MI among Inuit.

DIETARY MERCURY, OMEGA-3 FATTY ACIDS AND RISK OF MYOCARDIAL INFARCTION IN CANADA INUIT

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Inuit in the Canadian Arctic

Region	Population (2011)	% Population
Inuit Settlement Region	5,310	57.2
Nunavut	34,635	44.1
Northwest	>10,750	43.9
Northwest	2,206	44.9



Inuit Knowledge Centre





Inuit traditional foods



Beneficial nutrients:
Omega-3 fatty acids
Vitamin
Selenium

Contaminants:
Mercury
PCBs




Inuit peoples' health

- Used to be low in heart disease and stroke
- Quick dietary and life style transition recently
- High level of contaminants in traditional foods
- High smoking rate and diabetes prevalence; increasing blood pressure, blood cholesterol levels



Mercury, omega-3 FA and myocardial infarction

- Describe the modern Inuit diet, the EPA (20:5n3), DHA (22:6n3), methyl mercury (MeHg) intake
- Estimate contributions of mercury and n-3 FAs to the risk of MI
- Potential impact of promoting the consumption of more traditional food on Inuit's MI risk





Inuit Health Survey 2007 and 2008

48 communities partner with researchers

Survey content

- Clinical examination
 - Body composition
 - Blood pressure and pulse
 - Skeletal health for women > 40 yrs
 - Diabetes and Cardiovascular risk factors
- Nutrition markers
- Infection
- Contaminants

Mercury, omega-3 FA and myocardial infarction

- Model the relative risk of MI due to Hg and n-3 FA in two steps:
 - Step 1: from dietary intake to blood concentrations
 - Step 2: from blood concentrations to relative risk
- Modelled two scenarios:
 - Scenario 1: reported dietary intake of traditional foods and relative risk of MI
 - Scenario 2: more healthy traditional foods intake and relative risk of MI

Myocardial infarction in relation to mercury and fatty acids from fish: a risk-benefit analysis based on pooled Finnish and Swedish data in men^{1,2}

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Logistic Model Statquo

$$\ln(\text{OR}) = -0.027 \ln(\text{Mercury}) + 0.005 \ln(\text{Omega-3}) + 0.001 \ln(\text{Age}) + 0.001 \ln(\text{BMI}) + 0.001 \ln(\text{Diabetes}) + 0.001 \ln(\text{MI})$$

Summary of study participants

	Men	Women
Age (yr)	49.6 (5.0)	51.6 (5.7)
Body mass index	27.2 (6.0)	26.2 (6.0)
Blood total cholesterol (mmol/L)	4.82 (1.08)	4.86 (1.10)
Smoking (%)	47.8	10.0
Diabetes (%)	33.3	64.1
Diabetes (%)	6.0	6.0
Myocardial infarction (%)	5.16	3.91

EPA, DHA and Hg concentration per 100 grams traditional Inuit foods

Food Item	EPA	DHA	Mercury
Arctic char meal	0.02	0.21	11.2
Drifted caribou meal	0.01	0.01	3.0
Ringed seal meal	0.20	0.22	12.2
Beluga muktuk (skin & fat)	1.19	1.09	27.1
Georgie muktuk (skin)	0.23	0.30	43.9
Kusled seal liver	0.19	0.09	10.7
Harvalut muktuk (skin & fat)	0.01	0.48	32.3
Beluga roe	0.05	0.04	22.4
Harvalut muktuk (skin)	0.10	0.02	35.2
Top 10 Inuit average	0.24	0.20	19.0

Intake of EPA, DHA and MeHg from traditional Inuit foods

Food Item	Men				Women			
	Wgt	EFW	DH	MeHg	Wgt	EFW	DH	MeHg
Arctic char meal	69	0.47	0.37	7.7	44	0.23	0.23	4.9
Drifted caribou meal	29	0.29	0.08	3.3	18	0.22	0.04	2.1
Georgie muktuk (skin and fat)	10	0.27	0.19	4.3	8	0.1	0.06	2.4
Georgie muktuk (skin only)	2	0.23	0.01	4.0	3	0.23	0.00	2.5
Ringed seal liver	2	0.21	0.01	9.7	3	0.21	0.00	5.0
Harvalut muktuk (skin and fat)	2	0.23	0.04	2.0	3	0.22	0.01	1.0
Georgie roe	2	0.21	0.01	1.4	3	0.21	0.01	0.7
Harvalut muktuk (skin only)	4	0.21	0.01	1.0	4	0.21	0.01	1.6
Top 10 Inuit average	323	0.72	0.53	24.0	218	0.55	0.44	23.5

EPA, DHA and Mercury blood concentrations

Hg Particulate		EPA	DHA	Mercury Total
		(%)	(%)	(µg/L)
Hg Particulate	Men	1.05	2.99	14.08
	Women	1.37	2.50	15.90
Contaminant associated	Men	0.49	1.37	0.68
	Women	0.46	1.31	0.70

Relative risk of myocardial infarction due to Inuit traditional foods

Food Item	Men		Women	
	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Arctic char meal	0.303	1.01	0.275	1.077
Drifted caribou meal	0.864	1.00	1.00	0.864
Georgie muktuk (skin and fat)	0.302	1.00	0.260	0.964
Georgie muktuk (skin only)	0.304	1.00	1.00	0.304
Georgie roe	0.302	1.00	1.00	0.302
Harvalut muktuk (skin and fat)	0.863	1.00	1.00	0.863
Ringed seal liver	0.864	1.00	1.00	0.864
Harvalut muktuk (skin only)	0.302	1.00	1.00	0.302
Top 10 Inuit average	0.301	1.00	1.00	0.302

Ratio of EPA+DHA(mg) to MeHg(µg) for top consumed and local available healthy traditional foods.



Relative risk of MI due to local available healthy traditional foods

Food Item	1 serving/week	2 servings/week	3 servings/week	4 servings/week
Arctic char	1.00	1.00	0.95	0.90
Trout	1.00	1.00	0.98	0.94
Arctic char meal	1.00	0.95	0.90	0.84
Georgie muktuk	1.00	0.97	0.95	0.93
Ringed seal	1.00	0.96	0.93	0.91
Salmon	0.99	0.95	0.90	0.87

Summary

- Inuit people are young but with elevated MI risk factors
- Traditional foods contain both high EPA+DHA and MeHg
- Modern Inuit diet results a net "no protective" effect to MI
- Promoting more healthy traditional foods intake can reduce MI risk in Inuit

Everybody loves their food!



Acknowledgements

