

# Low Seafood Intake and Adverse Mental Health Outcomes

CDR, Joseph R. Hibbeln, M.D.

Laboratory of Membrane Biochemistry and Biophysics  
NIAAA, NIH, Rockville, MD

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Parliamentary Inquiry, London, UK

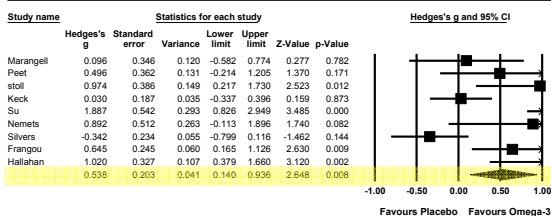
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## Hierarchy for Clinical Efficacy in Evidence Based Medicine

- Hypothesis
- Epidemiological association (Ecological)
- Direct case based observational associations
- Plausible biological mechanism
- Open (non-blinded) intervention trials
- Randomized masked placebo controlled trials
- Large scale, multi-center placebo controlled trials
- Meta-analysis, weighted analysis of efficacy
- Treatment recommendations

Meta-analysis of omega-3's on depressive symptoms, randomized placebo controlled trials, effect size = 0.54, p<0.008

### Omega-3 EFA in Affective Disorders



Effect Size g, SE, Variance 95% CI Z and P (Best Case)

Freeman M, Hibbeln JR, Davis JM et al.  
American Psychiatric Association's treatment recommendations for omega-3 fatty acids in psychiatric disorders. J Clin Psychiatry Dec 2006



U.S. Department of Health and Human Services  
and  
U.S. Environmental Protection Agency



### What You Need to Know About Mercury in Fish and Shellfish

#### 2004 EPA and FDA Advice For: Women Who Might Become Pregnant, Women Who are Pregnant Nursing Mothers and Young Children

Fish and shellfish are an important part of a healthy diet. Fish and shellfish contain high-quality protein and other essential nutrients, are low in saturated fat, and contain omega-3 fatty acids. A well-balanced diet that includes a variety of fish and shellfish can contribute to heart health and children's proper growth and development. So, women and young children in particular should include fish or shellfish in their diets due to the many nutritional benefits.

However, nearly all fish and shellfish contain traces of mercury. For most people, the risk from mercury by eating fish and shellfish is not a health concern. Yet, some fish and shellfish contain higher levels of mercury that may harm an unborn baby or young child's developing nervous system. The risks from mercury in fish and shellfish depend on the amount of fish and shellfish eaten and the levels of mercury in the fish and shellfish.

March 2004 EPA-823-R-04-005

## Avon Longitudinal Study of Parents and Children (ALSPAC)

Recruited 14,541 pregnant mothers, the largest and most complete longitudinal study in the world.

- Enrollment included every pregnancy between April 1<sup>st</sup> 1991 and December 31<sup>st</sup> 1992 in Avon (Southwest of London, UK)
- Children are now between 11.5 and 15 years of age
- Participants mail in questionnaires every 6 months
- 1,500 children have been seen in clinics every year since birth
- 85% of children have been seen in clinics every year starting at age 7
- Collaboration with John M. Davis, M.D. Univ. of Illinois
- Jean Golding, Ph.D., Pauline Emmett, Ph.D.- ALSPAC study group

## 28 Potential Confounding Variables were Uniformly Included in all Logistic Regression Analyses

### Individual (categorical) variables

1. Sex of the child (m,f),
2. Age of the mother (<= > 20 y),
3. Parity (primiparous, multiparous),
4. Maternal education (<completed O level, rest),
5. Housing status (subsidized public housing, rented, owned/mortgaged),
6. Crowding (<= > 1 per/room),
7. Stressful life events at 18 w gestation (upper 10%, lower 90% of cohort), had partner at time of birth (no, yes),
8. Smoking status (never, smoked before but not at 18 w gestation, or still smoking at 18 w gestation),
9. Alcohol use during pregnancy (non-drinker, drank before mid-pregnancy, still drinking mid-pregnancy) and
10. Breastfeeding (none, some) and
11. Ethnicity (White, Black, Asian),
12. Obstetric variables: prematurity (< > 3 w early) and birth weight (< > 5 Lbs, 3 oz).

### Composite (continuous) variables

13. HOME Score at 6 mo
14. ALSPAC Family Adversity Index (during pregnancy)

### Nutritional variables 12 food groups

Hibbeln et al, The Lancet, Feb 17, 2007

### Verbal IQ at age 8 and maternal intake of omega-3 fatty acids from seafood (en%) at 32 weeks gestation

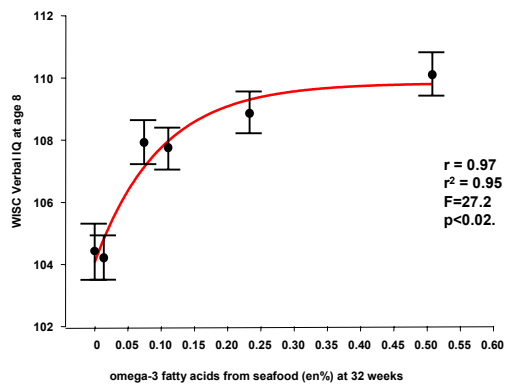
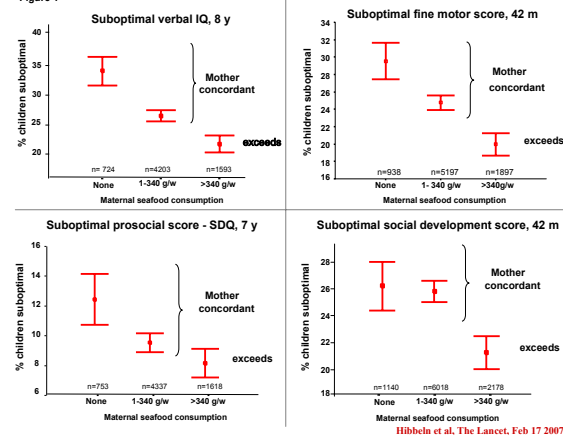
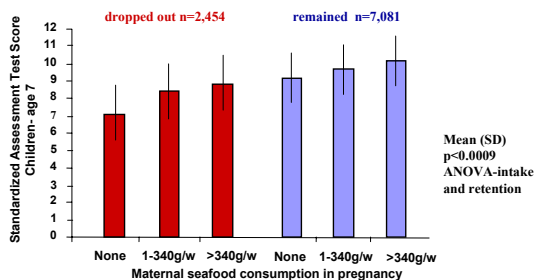


Figure 1



### Attrition bias?

Disproportionate attrition of low seafood/disadvantaged families  
SATs tests for all British public schools students, regardless of cohort dropout



Attrition underestimates the effects of low seafood consumption on cognition.

Hibbeln et al, The Lancet 17 Feb 2007

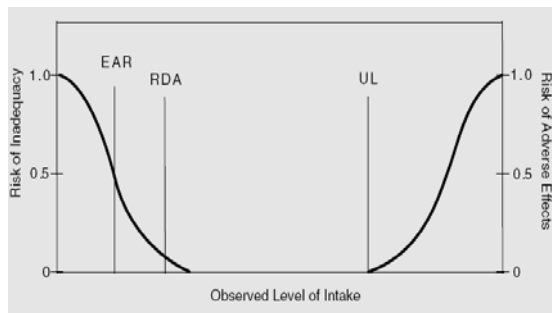
### ALSPAC Summary

1. Maternal limitation of seafood consumption to <340g/w during pregnancy did not protect children from adverse outcomes.
2. In contrast, this observational study showed beneficial effects on child development when maternal seafood intakes exceeded 340 g/w, with no upper limit of benefit.
3. These findings were robust after adjustment for multiple potential confounders.
4. These data indicate that advice for mothers to limit seafood intake, during pregnancy is detrimental, e.g limiting intake at the FSA level of 280 gm/w.

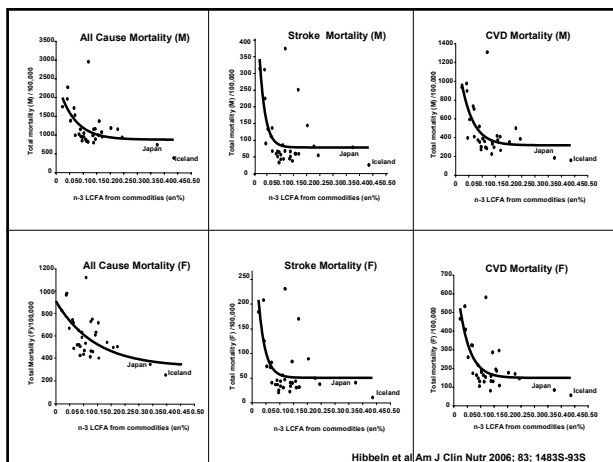
Hibbeln et al, The Lancet 17 Feb 2007

How much EPA and DHA should I eat each day?

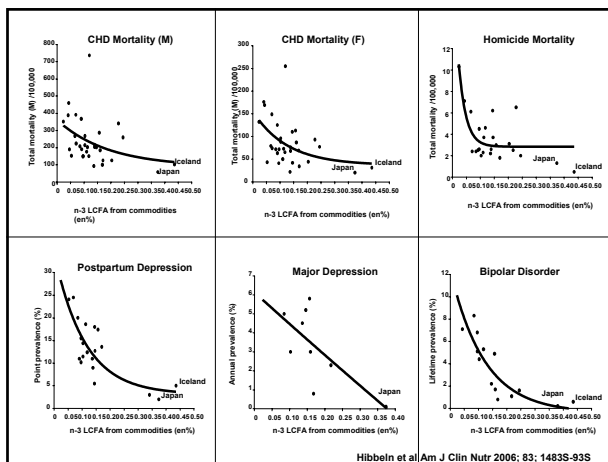
Calculation of daily intakes based on RDA criteria to prevent deficiencies.



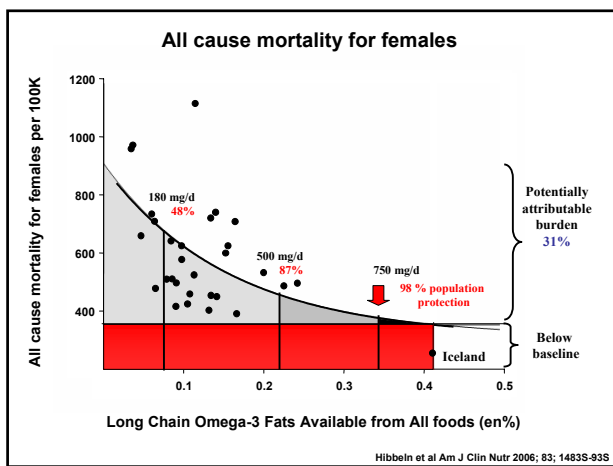
Dietary Reference Intakes: Guiding Principles for Nutrition Labeling and Fortification Committee on Use of Dietary Reference Intakes in Nutrition Labeling, National Academies Press, 2003



Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S



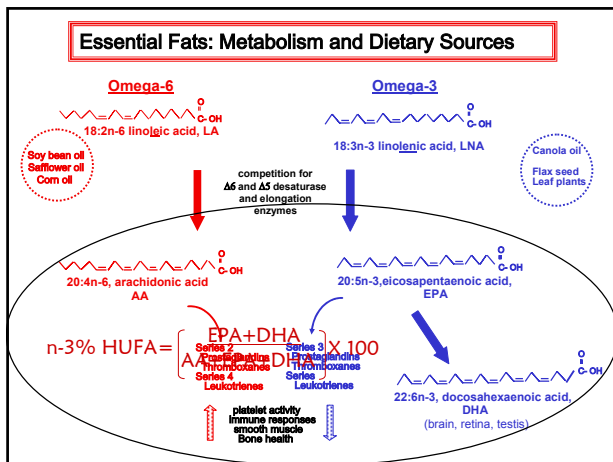
Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S



Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S

Disease/Disorder Model	Disease burden potentially modifiable by n-3 HUFAs	Percent vulnerable population protected from illness (%)		
		Model Advice for n-3 HUFA Intake		
		0.08 en% (180 mg/d)	0.22 en% (500 mg/d)	0.34 en% (750 mg/d)
CHD mortality M	41.2%	45.2	85.4	97.9
CHD mortality F	42.5%	52.4	89.7	98.6
Stroke mortality M	32.9%	97.7	99.9	>99.9
Stroke mortality F	31.1%	96.4	99.9	>99.9
CVD mortality M	26.1%	83.4	99.3	>99.9
CVD mortality F	29.1%	86.9	99.6	>99.9
All Cause mortality M	20.8%	73.6	97.7	99.8
All Cause mortality F	31.5%	48.3	87.3	98.2
Homicide mortality	28.4%	95.6	>99.9	>99.9
Postpartum depression	65.5%	55.7	91.3	98.9
Major depression	98.5%	38.5	83.2	99.2
Bipolar disorder	99.9%	56.1	92.3	99.5

Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S



COUNTRY	Tissue target n-3 HUFA	Concurrent dietary intake (en%)			n-3 HUFA required to meet tissue target in each country	
		LA	α-LNA	AA	(en%)	(mg/d)
Philippines	60%	0.80	0.08	0.06	0.125	278
Denmark	60%	2.23	0.33	0.09	0.45	1000
Iceland	60%	2.48	0.33	0.10	0.54	1200
Colombia	60%	3.21	0.24	0.04	0.51	1133
Ireland	60%	3.57	0.42	0.06	0.62	1378
UK	60%	3.91	0.77	0.07	0.72	1600
Netherlands	60%	4.23	0.28	0.08	0.88	1956
Australia	60%	4.71	0.49	0.07	0.90	2000
Italy	60%	5.40	0.51	0.06	0.95	2111
Germany	60%	5.57	0.62	0.06	1.00	2222
Bulgaria	60%	7.02	0.06	0.05	1.25	2778
Israel	60%	7.79	0.67	0.07	1.45	3222
USA	60%	8.91	1.06	0.08	1.65	3667

Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S

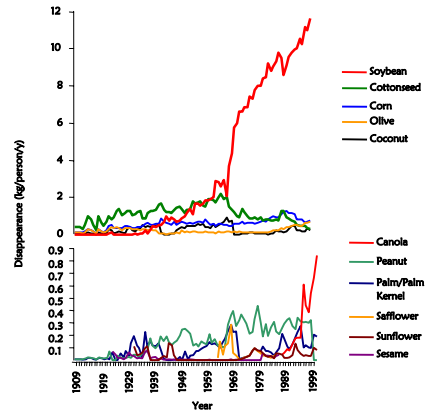
Dietary intakes of long chain omega-3 fats vary more than 10-fold necessary to achieve Japanese tissue levels (98% protection) of long chain omega-3 fatty acids

This variation is due to greater background intakes of linoleic acid (omega-6).

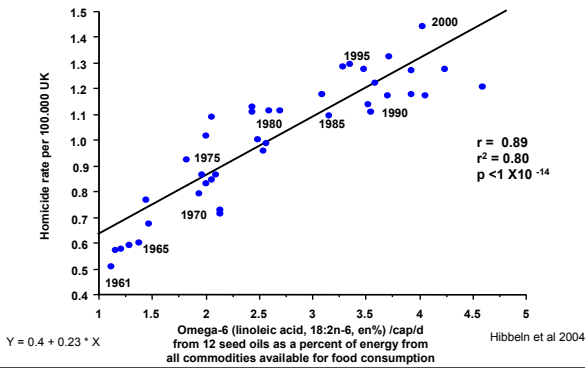
Lowering linoleic acid intakes from seed oils can reduce the burden on fisheries.

Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S

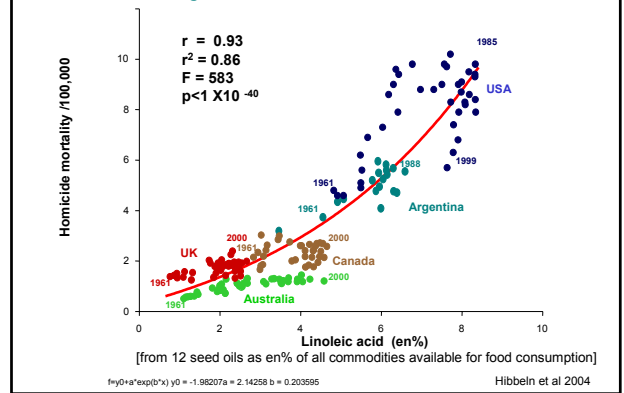
Oilseeds in the US Food Supply in the 20<sup>th</sup> Century



Homicide mortality in the United Kingdom and availability of Omega-6 fats (18:2n-6) in the food supply 1961-2000



Homicide mortality and availability of linoleic acid (en%) Combined Australia, United Kingdom, Canada Argentina and USA data from 1961-2000



## Action

1. Support and encourage maternal seafood and omega-3 consumption in pregnancy to protect children from lifelong adverse behavioural and educational harms.
2. Establish recommendations for minimum daily intakes of EPA and DHA considering mental health outcomes.
3. Determine if high levels of dietary linoleic acid from seed oils is safe and is not contributing to increasing rates of violence.
4. Support fisheries habitats and ecologically safe aquaculture.