Nutrition and the Modern Mind

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Every person with a brain deserves good nutrition!
Nutritional medicine as mainstream in psychiatry

Jerome Sarris, Alan C Logan, Tasnime N Akbaraly, G Paul Amminger, Vicent Balanzá-Martínez, Marlene P Freeman, Joseph Hibbeln, Yutaka Matsuoka, David Mischoulon, Tetsuya Mizoue, Akiko Nanri, Daisuke Nishi, Drew Ramsey, Julia J Rucklidge, Almudena Sanchez-Villegas, Andrew Scholey, Kuan-Pin Su, Felice N Jacka, on behalf of The International Society for Nutritional Psychiatry Research

Lancet Psychiatry, 2015

• The emerging and compelling evidence for nutrition as a crucial factor in the high prevalence and incidence of mental disorders suggests that **diet is as important to psychiatry as it is to cardiology, endocrinology, and gastroenterology.**

• Evidence is steadily growing for the relation between dietary quality (and potential nutritional deficiencies) and mental health, and for the select use of nutrient-based supplements to address deficiencies, or as monotherapies or augmentation therapies.

• The members of the International Society for Nutritional Psychiatry Research advocate recognition of diet and nutrition as central determinants of both physical and mental health.
Family love and social learning

Seed
Genetic Inheritance

Soil
Essential Brain Nutrients

Omega-3 fats

Poor Soil
Deficient in Nutrients

Omega-6 fats

Family chaos and social strife

Neuron

Pb
Adequate DHA (22:6n-3)       Deficient (22:5 n-6)

n-3 HUFA deficient diets cause 50% loss of dopaminergic neurons

“Poor” diets are associated with smaller brain volumes

“Good” diet: fresh vegetables, salad, fruit and grilled fish
“Poor” diet: roast meat, sausages, hamburgers, steak, chips, crisps and soft drinks

Essential Fats: Metabolism and Dietary Sources

**Omega-6**

- 18:2n-6 linoleic acid, LA
  - Soybean oil, Safflower oil, Corn oil

- 20:4n-6, arachidonic acid, AA
  - Meat, Organs

- 22:5n-6, DPA n-6

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**Omega-3**

- 18:3n-3 alfa-linolenic acid, ALA
  - D6 desat, D5 desat, D6 desat, FADS 1-2
  - Flax, Canola Leaf plants

- 20:5n-3, eicosapentaenoic acid, EPA
  - Seafood, Breast milk (DHA)

- 22:6n-3, docosahexaenoic acid, DHA, (brain, retina, testis)

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**Bioactive lipid mediators**

- 2-series Prostanoids, 4-series Leukotrienes, Lipoxins, HETEs, EETs, AEA (anandamide), 2-AG
  - immune - metabolic - developmental responses

- 3-series Prostanoids, 5-series Leukotrienes, Resolvins, Maresins, Protectins, n-3 monoepoxides, DHA-EA (synaptamide), 2-DHG

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- Competition
Aspirin
Other drugs
>$10 Billion

PGE2
TXA2

"Marijuana like"
2-AG / AEA

Obesity
Addictions
Depression

Thrombosis

COX 1-2

Synapatmide
DHA-EA

New synapses
Neural resilience
FOODS

Omega-3
Plants/Leaves/Insects

Traditional Farming & Poultry Raising Utilized a More Varied, Natural & Wild-Type Diet - Rich in Omega-3

n-3
Chicken

n-6
Chicken

Wild Fish

Grass Fed Lamb

Farm Beef

Farm Fish

Olive Oil

Soy Oil

Omega-6
Plants/Seeds

In the Last Century, Industrialized Farming of Soya and Corn Has Changed Chicken to Be High in n-6 and Low in n-3

Reduced Inflammation & Disease Risk

Strong Inflammation & Disease Risk

Omega-3 in Body

70% Achievable
Trad. Inuit

60% Superb
Trad. Japanese

50% Healthy
Mediterranean

40% Action
Beneficial

30% Remedial
Action

20% Urgent
Action

17% US Now
DANGER
Soy oil Consumption Increased 1,000 fold in the 20th Century, USA

Blasbalg et al.(Hibbeln group), AJCN 2011; 93: 950-962.
Dietary fats and neuro-inflammation in mental ill health

Inflammatory cascade
- Cytokines
- Chemokines
- COX 1-2
- IL-1β
- PGE2
- EtOH

Neurogenesis
- BDNF
- 

Risks
- Stress
- Anxiety
- Social isolation
- Depression
- Impulsivity

Dietary fats
- LA
- AA
- 2-AG/AEA
- DHA-EA
- DHA/EPA

Macrophage
- PPARα
- TLR
- P38 MAPK, JUN

Intestine
- EtOH

Microglia
- M0
- M1
- M2

Brain
- NFkB
- ACTH
- CRH
- 5-HT
- KYNA
- QUIN
- NMDA
- DA
- BDNF

↑ Risks
- Stress
- Anxiety
- Social isolation
- Depression
- Impulsivity

↓ Reward
<table>
<thead>
<tr>
<th>Disorder</th>
<th>Plausible mechanism</th>
<th>Epidemiological</th>
<th>Case control (Tissue)</th>
<th>RCT’s</th>
<th>Meta-analyses</th>
<th>Positive clinical effect? Size?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major depression</td>
<td>Yes</td>
<td>54</td>
<td>17</td>
<td>52</td>
<td>6</td>
<td>Yes Large effect</td>
</tr>
<tr>
<td>ADHD</td>
<td>Yes</td>
<td>6</td>
<td>15</td>
<td>10</td>
<td>2</td>
<td>Yes Less than stimulants</td>
</tr>
<tr>
<td>Aggression violence/conduct</td>
<td>Yes</td>
<td>8</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>Replicates Large effect ↓ 40% in felony violence</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Yes</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>-</td>
<td>Probable -</td>
</tr>
<tr>
<td>Alcohol/Sub. use</td>
<td>Yes</td>
<td>-</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>Hopeful Large effect</td>
</tr>
<tr>
<td>Suicide</td>
<td>Yes</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>Hopeful</td>
</tr>
</tbody>
</table>
Fish Consumption and Major Depression
Annual Prevalence by Country

- New Zealand (5.8%)
- Canada (5.2%)
- France (4.5%)
- W. Germany (5.0%)
- United States (3.0%)
- Puerto Rico (3.0%)
- Korea (2.3%)
- Taiwan (0.8%)
- Japan (0.12%)

$r = -0.84$
$p < 0.005$

Hibbeln, The Lancet 1998;351;1213
## Mediterranean dietary patterns to reduce depression?

**fish, olive oil and n-3 HUFAs as causal agents**

1. **Dietary patterns**
   - Healthy
   - Mediterranean

   2015 Dietary Guidelines for Americans Scientific committee evaluated ONLY data on dietary patterns for depression.

2. **Specific foods**
   - Fish
   - Olive oil

   **Fish consumption:** a meta-analysis including *n=26* studies, *n=150,278* lower risks of depression. **RR= 0.83** (95% CI 0.74 to 0.93)
   
   Li F, et al. J Epidemiol Community Health 2015;0:1–6

3. **Specific nutrients**
   - n-3 HUFAs

   **Blood levels:** a meta-analysis of *n=14* studies with *n=3,318* participants indicate higher blood levels of n-3 HUFAs are associated with lower risks of depression. **g= 0.85, p<0.0000** Lin et al, Biol Psychiatry 2010;68:140–147

4. **RCTs**
   - n-3 HUFAs vs. placebo

   **Causal testing:** a meta-analysis of *n=52* study conditions with *n=11,038* participants indicate **EPA rich**, n-3 HUFAs treat symptoms in major depressive disorders. **g=0.61** Hallahan, Hibbeln et al, Br J Psychiatry, 2015

5. **Mechanistic basis**

   Multiple synergistic biological processes: n-3 HUFAs in neuroinflammation, dopaminergic and serotonergic function, neurogenesis and the stress axis

6. **Olive oil**

   Olive oil, instead of vegetable oils, lowers intake of omega-6 fats and raises blood levels of **EPA** and is associated with lower risk of depression.

Can we stop this?
Homicide Mortality Rates\(^1\) and Seafood Consumption

![Graph showing the correlation between apparent seafood consumption (lbs/pers/year) and homicide deaths per 100,000 (Male + Female) across 26 countries. The correlation coefficient is \(r = -0.63\), with a p-value of \(p < 0.0006\).]

1 World Health Statistics Annual 1995, WHO, Geneva Switzerland

Hibbeln, JR  World Rev Nutr Diet, 2001; 88; 41-46
Mauritius Child Health Project

Age 8-16, Randomized, stratified by age, genderBlinded, 38.7% Creole, 61.3% Indian

n=95 omega-3, n= 89 placebo
6 mo. intervention, 6 mo. follow up Child Behavior Checklist (parent)

Omega-3 specific

Delinquency Group x Time, p = .0001
p < .001 d = .52

1 gm omega-3 or placebo
200 ml Smoothie
116 Kcal
Vitamin D (17%)
Antioxidants

Child Proactive Aggression

Child Reactive Aggression

Raine, Hibbeln et al 2014
Parents were less psychopathic when their children took omega-3’s

*Parent Psychopathic Personality Inventory*

Raine, Hibbeln et al, 2014
Reduced Felony Violent Offences Among Prisoners with recommended daily amounts of vitamins, minerals and essential fatty acids

UK maximum security prison - 338 offences among 172 prisoners over 9 months treatment in a compared to 9 months baseline.

How about addictions?
Alcohol consumption and increasing omega-6 fatty acids in tissue compositions (est) in the 20th century

\[ r^2 = 0.81 \]

\[ p > 0.00001 \]
Cigarette consumption and increasing omega-6 fatty acids in tissue compositions (est) in the 20th century

1909-1970
$r^2=0.97$
p>0.00000
Mediterranean Diet

Current US Diet

<table>
<thead>
<tr>
<th>Short n-6 LA</th>
<th>8 en%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long n-6 HUFA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short n-3 α-LA</th>
<th>1 en%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long n-3 HUFA</td>
<td></td>
</tr>
</tbody>
</table>

Excess Alcohol

+  O₂* - oxygen reactive species

Desaturation

FADS 1-2

Replaces n-6 HUFA but n-3 DHA ↓ by 50%


Depletes Brain HUFAs
Comparison oil (placebo), Corn oil +1% fish oil
Active Agent, 2 g/d DHA plus EPA
Randomize
Clinic Clinic Clinic Clinic Clinic Clinic Clinic Clinic Clinic Clinic Clinic
Final
Aggressive Alcoholics, n=96
Seafood < 2/wk
Time line (weeks)
↑ Admission 21 days 0 1 2 3 4 5 6 7 8 9 10 11 12
Baseline ψ test battery lumbar puncture- CSF MRI HRV
Ψ Psychotherapy
Ψ test battery lumbar puncture- CSF MRI HRV
Enrolled n=99

Randomized n=96

Control oil n=48

Drop out n=9

Elevated n-3 HUFA n=1

Unchanged n-3 HUFA n=38

Elevated n-3 HUFA n=28

n-3 HUFA oil n=48

Drop out n=12

Unchanged n-3 HUFA n=8

Elevated n-3 HUFA n=29

Unchanged n-3 HUFA n=46

Not randomized n=3

Elevated n-3 HUFA n=29

Elevated n-3 HUFA n=28

Unchanged n-3 HUFA n=46

Unchanged n-3 HUFA n=38
Biomarker defined compliance (change in n-3 HUFAs) and risk of heavy drinking days (HDD) in the first 90 days of recovery

Change from baseline of n-3 % in HUFA in plasma

Odds of ≥ 10 HDD non-achievers vs. achievers
## Risk of heavy drinking days by n-3 HUFA compliance

<table>
<thead>
<tr>
<th>(unadjusted)</th>
<th></th>
<th>(adjusted)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% C.I.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td><strong>5 or more HDD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No n-3 HUFA elevation</td>
<td>2.40</td>
<td>0.88</td>
<td>6.56</td>
</tr>
<tr>
<td>No sober housing</td>
<td>2.71</td>
<td>0.86</td>
<td>8.56</td>
</tr>
<tr>
<td><strong>10 or more HDD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No n-3 HUFA elevation</td>
<td>6.59</td>
<td>1.73</td>
<td>25.05</td>
</tr>
<tr>
<td>No sober housing</td>
<td>5.52</td>
<td>1.33</td>
<td>22.86</td>
</tr>
<tr>
<td><strong>20 or more HDD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No n-3 HUFA elevation</td>
<td>5.06</td>
<td>1.04</td>
<td>24.63</td>
</tr>
<tr>
<td>No sober housing</td>
<td>7.29</td>
<td>1.17</td>
<td>45.32</td>
</tr>
</tbody>
</table>

HDD indicates Heavy Drinking Days.
> 5 std drinks for women > 6 std drinks for men

“Achiever” defined as n-3 HUFA elevation ≥5% change in CSF/ plasma n-3% in HUFA
Chronic Daily Headache

Why study pain?

$300$ billion/y in healthcare costs (IOM, 2013)
↑ Risk for suicide
↑ Risk for substance abuse
Treatments are inadequate

Patient population

Chronic Daily Headache
Severely impaired 23 d/month, 10 h/day
Treatment resistant > 6 meds

Ramsden CE, (Hibbeln) et al., Trials 2011
Does total dietary ↓ n-6 LA and/or ↑ n-3 HUFA reduce headache pain, frequency and disability?

Randomization, Blood Collection

**H3-L6, intervention**

LA - 2.4 en%, n-3 HUFA - 1,482 mg/d

Baseline Phase

LA - 7.4 en%, n-3 HUFA - 45 mg/d

**L6 intervention**

LA - 2.4 en%, n-3 HUFA - 47 mg/d

Study End, Blood Collection

Patients continued usual headache care throughout trial

Ramsden CE, (Hibbeln) et al., *Trials* 2011
Dietary essential fats reduce severe headache pain

Between-group comparisons

- HIT-6: p<.001
- % severe: p<.02
- d/m: p<.02
- h/d: p<.01

Ramsden CR, (Hibbeln JR) et al, Pain 2013
The H3-L6 intervention reduces hours of daily headaches compared to n-6 LA lowering alone.
Hi Doc,
I heard that changing my diet can improve my mental health.
Can you help?

Great idea!
But, I’m not an expert on diet or nutrition.
Let me consult a dietician.

Great idea!
But, I don’t have any guidance from anyone as to what improves mental health or how to advise these clients.
What diet for mental health?

The Mediterranean Dietary Pattern

Fish 2-3 times per week
Olive oil, *not* vegetable oils

Avoid processed carbohydrates
More fruits and vegetables
Less red meat?
No fried foods
Linoleic acid is 2-3% of energy in traditional Mediterranean diets

“One common feature of Mediterranean diets was the use of olive oil as the principle fat, “

“Given a requirement of ~2-3 % of energy, the amount of linoleic acid in olive oil would alone provide sufficient intake, if olive oil constituted 25% of energy.”

### Eat less n-6 LA to help raise body n-3 HUFAs

<table>
<thead>
<tr>
<th>Omega-3 Index</th>
<th>n-3 % in HUFA</th>
<th>17% US MILITARY ACTIVE DUTY</th>
<th>20% TAKE URGENT ACTION</th>
<th>30% TAKE REMEDIAL ACTION</th>
<th>40% ACTION BENIFICAL</th>
<th>50% HEALTHY OMEGA-3 LEVEL</th>
<th>60% ADJUST FOR OPTIMAL</th>
<th>70% OPTIMAL OMEGA-3 LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy</td>
<td>8 en% n-6 LA + n-3 HUFA</td>
<td>50 mg/d</td>
<td>250 mg/d</td>
<td>750 mg/d</td>
<td>22,000 mg/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive</td>
<td>3 en% n-6 LA + n-3 HUFA</td>
<td>50 mg/d</td>
<td>250 mg/d</td>
<td>750 mg/d</td>
<td>22,000 mg/d</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Miracles of Jesus in Galilee

NABRE

And he led them to the sea, and drew up the fish, and the seven bushels of fish fell together, and when they saw it, they were astonished, and they called the Lord’s name. (Matthew 17:27)

And when they got out of the boat, they were amazed, and when they had gathered together they came to land at Capernaum. (Matthew 16:14-20)

...And when the disciples of the Lord entered the town, they asked him to enter their house. (John 4:14-20)

...And he said to them, “Can the net of the fish, if it is cast into the sea, be taken empty? They cast therefore, and they found a great number of fish.” (John 21:6)

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...And he said to them, “Can the net of the fish, if it is cast into the sea, be taken empty? They cast therefore, and they found a great number of fish.” (John 21:6)
Nix the omega-6

Avoid
- Sunflower oil
- Soybean oil
- Corn oil
- Sesame oil
- Peanut oil

Better
- Canola oil

Eat these
- Flaxseed oil
- HO Safflower
- Olive oil
- Palm oil
- Macadamia nut oil
Quick fix

The USDA 100 most frequently consumed foods for Americans have a combined average score of -6

Eliminating these 10 non-Mediterranean foods will bring the remaining 90 foods down to a combined average score of -3

The ten most negative key foods for Americans

<table>
<thead>
<tr>
<th>Food</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean oil</td>
<td>-50</td>
</tr>
<tr>
<td>Mayonnaise</td>
<td>-46</td>
</tr>
<tr>
<td>Tub margarine</td>
<td>-39</td>
</tr>
<tr>
<td>Microwave popcorn</td>
<td>-37</td>
</tr>
<tr>
<td>“Italian salad” dressing</td>
<td>-35</td>
</tr>
<tr>
<td>Potato chips</td>
<td>-29</td>
</tr>
<tr>
<td>Stick Margarine</td>
<td>-28</td>
</tr>
<tr>
<td>Vegetable shortening</td>
<td>-28</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>-24</td>
</tr>
<tr>
<td>Tortilla chip snacks</td>
<td>-24</td>
</tr>
</tbody>
</table>
The Brain Food Scale (BFS)

Given the high burden of disability due to mental disorders and the clear role that food choice can play in mitigating mental health risk, a scale to rank foods most likely to support brain health was developed.

Specific nutrients such as vitamin B12, long-chained omega-3 fatty acids, and iron are frequently deficient in mental health patients.

Scales of nutrient density, antioxidant capacity, and “power house” fruits and vegetables have ranked foods before, but no current scale based on specific brain essential nutrients (BEN) has been developed to our knowledge.

Several BEN are only found in meat, seafood, eggs, and dairy, which are generally excluded from lists of “superfoods” and rankings of nutrient density.

The objective of the current study was to determine which plant and animal based foods contain the highest nutrient density of brain essential nutrients.
<table>
<thead>
<tr>
<th>Top 20 Brain Foods: Animals</th>
<th>BFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oysters</td>
<td>51%</td>
</tr>
<tr>
<td>Clams</td>
<td>32%</td>
</tr>
<tr>
<td>Beef Spleen</td>
<td>31%</td>
</tr>
<tr>
<td>Chicken Liver</td>
<td>28%</td>
</tr>
<tr>
<td>Mussels</td>
<td>26%</td>
</tr>
<tr>
<td>Crab</td>
<td>24%</td>
</tr>
<tr>
<td>Poultry Giblets</td>
<td>23%</td>
</tr>
<tr>
<td>Octopus</td>
<td>22%</td>
</tr>
<tr>
<td>Fish Eggs (Caviar)</td>
<td>21%</td>
</tr>
<tr>
<td>Beef Kidney</td>
<td>20%</td>
</tr>
<tr>
<td>Seal</td>
<td>19%</td>
</tr>
<tr>
<td>Caribou</td>
<td>18%</td>
</tr>
<tr>
<td>Cuttlefish</td>
<td>18%</td>
</tr>
<tr>
<td>Whale</td>
<td>17%</td>
</tr>
<tr>
<td>Bluefin Tuna</td>
<td>17%</td>
</tr>
<tr>
<td>Rainbow Trout (wild)</td>
<td>17%</td>
</tr>
<tr>
<td>Bluefish</td>
<td>17%</td>
</tr>
<tr>
<td>Elk</td>
<td>16%</td>
</tr>
<tr>
<td>Smelts</td>
<td>16%</td>
</tr>
<tr>
<td>Herring</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Top 20 Brain Foods: Plants</th>
<th>BFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mustard Greens</td>
<td>74%</td>
</tr>
<tr>
<td>Spinach</td>
<td>69%</td>
</tr>
<tr>
<td>Turnip Greens</td>
<td>61%</td>
</tr>
<tr>
<td>Green Bell Pepper</td>
<td>60%</td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>54%</td>
</tr>
<tr>
<td>Red Cabbage</td>
<td>50%</td>
</tr>
<tr>
<td>Kohlrabi</td>
<td>48%</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>46%</td>
</tr>
<tr>
<td>Red Bell Pepper</td>
<td>45%</td>
</tr>
<tr>
<td>Collard Greens</td>
<td>44%</td>
</tr>
<tr>
<td>Broccoli</td>
<td>43%</td>
</tr>
<tr>
<td>Acerola</td>
<td>40%</td>
</tr>
<tr>
<td>Scotch Kale</td>
<td>40%</td>
</tr>
<tr>
<td>Lemon</td>
<td>38%</td>
</tr>
<tr>
<td>Strawberry</td>
<td>38%</td>
</tr>
<tr>
<td>Brussels Sprouts</td>
<td>37%</td>
</tr>
<tr>
<td>Pummelo</td>
<td>36%</td>
</tr>
<tr>
<td>Asparagus</td>
<td>33%</td>
</tr>
<tr>
<td>Papaya</td>
<td>32%</td>
</tr>
<tr>
<td>Dandelion Greens</td>
<td>31%</td>
</tr>
</tbody>
</table>

BFS *Brain Food Score, Mean % daily value of brain essential nutrients per 100 calories
Omega Foods Apps plus Tools

Omega Foods Apps plus Tools Inform Your Food Choices

**Apps with Omega 3-6 Balance Scores** – Apps help you find foods with more positive Scores that will increase the omega-3 in your tissue HUFA. When you know the Score, it helps you eat less food with a big negative Score (that will increase the omega-6). Plan to NIX6 and EAT3.

**Finger-tip blood-spot test** – This health risk assessment biomarker tells your current balance of HUFA and informs you how much change you need to make to meet your personal wellness goals.

**NEW, Free Software to Plan Meals** – **Omega Meals** is a new interactive personal computer program that replaces KIM-2 (Keep It Managed). It uses Omega 3-6 Balance Scores to let you see a food’s impact. **Omega Meals** manages EFA contents of over 9,000 food servings, fitting them to each person’s taste, lifestyle and risk aversion. Download for either a Mac or Windows computer.
“Unless we prioritize brain nutrition, we will become a race of morons. The future health and intelligence of humanity is at stake, and it’s the most serious threat of our times”
- 1972 -

Prof. Michael Crawford. PhD, FRSB, FRCPath,

Order of the Rising Sun, 2015, Tokyo, Japan.
Alexander Leaf Distinguished Scientist Award for Lifetime Achievement. ISSFAL, 2016
Thank you
2015 Dietary Guidelines for Americans

• Strong evidence ... has shown that eating patterns that include seafood are associated with reduced risk of CVD,

• Moderate evidence indicates that these eating patterns are associated with reduced risk of obesity.

• Emerging evidence also suggests that relationships may exist between eating patterns and some neurocognitive disorders and congenital anomalies

• Omega-3 (n-3) fatty acids are a type of polyunsaturated fats found in seafood, such as salmon, trout, herring, tuna and mackerel and in flax seeds and walnuts. EPA and DHA are long chain n-3 fatty acids found in seafood.
Average intake of total protein foods is close to recommendations,

But, average seafood intake is below recommendations for all age-sex groups.

Shifts are needed within the protein foods group to increase seafood intake.

Seafood as the protein foods choice in meals twice per week in place of meat, poultry, or eggs.
Hibbeln et al Am J Clin Nutr 2006; 83; 1483S-93S