Benefits of Fish Consumption

Alan Jackson
Institute of Human Nutrition
University of Southampton

Committee on Medical Aspects of Food and Nutrition Policy

(COMA, 1994, Nutrition Aspects of Cardiovascular Disease)

We recommend that people eat at least two portions of fish, of which one should be oily fish, weekly.

Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment

2001: guidance possible harmful effects as a result of environmental pollution
dioxins and dioxin-like polychlorinated biphenyls (PCBs)
Build up in fatty tissues and hence oily fish
Potential to damage developing fetus Possible cause of cancer

Balance of Risk and Benefit

Nutritional and Toxicological considerations

Joint Committee:
Scientific Advisory Committee on Nutrition
Committee on Toxicology

Balance of benefit and harm nutrition and toxicology
Specific vulnerability of different population groups

If population were to follow advice consumption of oily fish would increase 2 to 3 times. Sustainability of resource to meet human requirements
Explicit statement
To formalise process through which evidence is collected and evaluated – approach

Consistent
Systematic
Transparent

Potential health benefits of oily fish/ w-3 fatty acids
Cardiovascular disease:
- secondary prevention (arrhythmias)
- plaque stability, clotting, anti-inflammatory

Pregnancy:
- duration and size at birth

Neuro-cognitive development and function:
- infant, term/preterm; childhood; older people

Other:
- blood pressure, obesity, arthritis.

Critical factor in oily fish consumption – dietary DHA

FSA Recommendations on Fish Consumption 2004
Recommended Upper Limit Intake (portions/week)

<table>
<thead>
<tr>
<th></th>
<th>Oily Fish</th>
<th>White Fish</th>
<th>Canned Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Pregnant women &amp; men</td>
<td>up to 4</td>
<td>No limit</td>
<td>No limit</td>
</tr>
<tr>
<td>Girls &lt;16y</td>
<td>up to 2</td>
<td>No limit</td>
<td>No limit</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>up to 2</td>
<td>No limit</td>
<td>up to 4 cans</td>
</tr>
<tr>
<td>Lactating women</td>
<td>up to 2</td>
<td>No limit</td>
<td>No limit</td>
</tr>
</tbody>
</table>

1 portion = 140g fish or ~ 0.45 g/d long chain w-3

Fish in Human Nutrition
1. Cod liver oil
- vitamin A and D (fortified yellow spreads)

2. Fish oils
- fish meat, w-3 fatty acids (omega-3)
- prevent disease, promote health

Critical factor in oily fish consumption – dietary DHA

Ability to form adequate amounts of DHA unclear.
This may be especially important during pregnancy.
Pregnancy and lactation period of greatest vulnerability for possible toxicants.

Fatty acids
- saturated fatty acids, lard
- mono-unsaturated fatty acids, olive oil
- polyunsaturated fatty acids
  - w-6 (corn oil) and w-3 (fish oil)

Polyunsaturated fatty acids
- critical structural component of all cell membranes
- regulate cell function
  - precursors for second messengers
Essential fatty acids (polyunsaturated, PUFA):
- have to be taken preformed in diet
- two families,
  - w-6 – linoleic acid
  - w-3 – linolenic acid (ALNA)

Fatty acids:
Long Chain Polyunsaturated Fatty Acids (LCPUFA)
Fish rich source of LCPUFA, especially w-3 fatty acids
Membranes of neurones in brain:
require substantial amounts of w-3 fatty acids especially during development
DHA (w-3 fatty acid) especially important
taken preformed in diet
formed from other w-3 PUFA (limited capacity)

Long Chain Polyunsaturated Fatty Acids (LCPUFA)

What determines your capacity to make DHA?
• Availability of the precursor αLNA
  • what you eat
  • what you have in adipose tissue
• Metabolic machinery
  • capacity of liver
  • micronutrients = Zinc, Iron, Magnesium
• Oestrogen status

If any of these are constrained, then the supply of DHA will be constrained unless consumed preformed in the diet

w-3 Fatty acids
Dietary supply of DHA is marginally adequate,
intake is not changed during pregnancy and lactation
Meeting increased requirement depends on:
  conservation of LCPUFA by reduced oxidation
  amount of pre-formed EPA and DHA which can be accessed from adipose tissue reserves
  the ability to increase the formation of DHA from precursors such as αLNA.

w-3PUFA intake & development (SACN 2004)
Maternal fish consumption or FO supplementation
  ↑ DHA ‘status’ of mother & infant (Sanjurjo ~ 1995; Connor ~ 1996)
  ↑ DHA content of breast milk (Makrides ~ 1994)
      (Breast milk has greater DHA than infant formula)
  ↓ risk of preterm delivery (Olsen & Secher 2000)
      effect most evident in low intake and small babies
  ↑ mental processing (Helland ~ 2003)
  ↑ visual function / evoked potentials (Williams 2001; Jorgensen ~ 2001)
Breast milk vs Formula ± FO supplementation

**in Preterm Infant**
- ↑ visual function / evoked potentials (9/10 studies)
- ↑ behavioural development (1/4 studies)

**in Term Infant**
- ↑ visual function / evoked potentials (7/11 studies)
- ↑ behavioural development (3/7 studies)

Need more research on how maternal w-3PUFA intake affects pregnancy outcomes and follow-up

---

**BODY GROWTH**

- **Stature and size**
  - Height, Weight

- **Proportions**
  - Body composition

- **Function**
  - Physiological maturation

- **Mental/intellectual development**
  - Neurological maturation development

- **Social development**
  - Social interaction

Development is structured:
- an ordered process in space and time

---

**Growth:**

- demand - play/stimulation
- nutrient availability
- maturation/development

**Vulnerability:**

- structure established
- maturation enabled
- development acquired

Later builds on earlier

---

**Nutrition of the brain:**

- carbohydrates energy
- lipids membrane structure
- amino acids neurotransmitters
- minerals and micronutrients regulation, control and integration

---

**Committee on Medical Aspects of Food and Nutrition Policy**

(COMA, 1994,
Nutrition Aspects of Cardiovascular Disease)

We recommend that people eat at least two portions of fish, of which one should be oily fish, weekly.