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

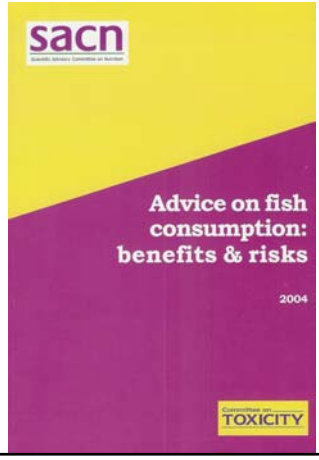
Nutritional and Toxicological considerations

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



## Scientific Advisory Committee on Nutrition Framework for the Evaluation of Evidence Relates Diet and Nutrition to Health

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)

| | Oily Fish | White Fish | Canned Fish |
|---|---|---|---|
| Non-Pregnant women & men | up to 4 | No limit | No limit |
| Girls <16y | up to 2 | No limit | No limit |
| Pregnant women | up to 2 | No limit | up to 4 cans |
| Lactating women | up to 2 | No limit | No limit |

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)

linoleic acid ⟶ arachidonic acid

linolenic acid ⟶ EPA ⟶ DHA

Fatty acids:
Long Chain Polyunsaturated Fatty Acids (LCPUFA)

Fish rich source of LCPUFA, especially w-3 fatty acids

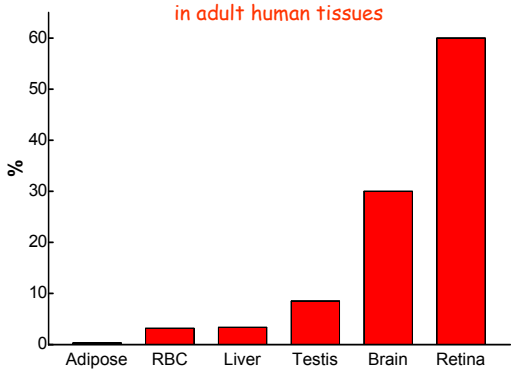
Membranes of neurones in brain:
require substantial amounts of w-3 fatty acids
especially during development

DHA (w-3 fatty acid) especially important

taken preformed in diet

formed from other w-3 PUFA (limited capacity)

Docosahexaenoic acid (DHA) concentration in adult human tissues




## 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.**

## 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
  - microutrients – 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-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)

↑ gestation length (Olsen ~ 1992 & 2000; Smuts ~ 2003)
↓ 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)

## w-3PUFA intake & development (SACN 2004)

Breast milk v 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*** |
| **- 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.**