“The Big Fat Debate”

Food Matter Live Conference
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Excel Exhibition Centre, London
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Fellow of the Institute of Food Science Technology
Scientific Communication Manager for DSM Nutritional Products for 7 years.

- Vice chair of UK Council for Responsible Nutrition (CRN)
- Member, former Chair of the scientific committee of the global trade body GOEDomega3
- Member (former Vice Chair) of the Lipids group of the Society for Chemical Industry (SCI)
- Member of the International Society of Fatty Acids and Lipids (ISSFAL)
- Lead contributor to the www.nutri-facts.org web site

E-mail: Rob.winwood99@gmail.com
• Low fat commercial foods products are healthier
• When I eat fatty foods, the calories go straight to my waistline
• All calories are the same
• The UK government knows best about my nutrition
• All PUFAs are good for you
• All Sat Fats are bad for you
• Plant derived omega 3s are as good as those from fish.
• Eating cholesterol will give me a heart attack

BIG
FAT
LIES!
Thin truths

• If I reduce my blood cholesterol, I am less likely to have a heart attack
• Cholesterol reducing foods are good for me
• Saturated fats intake increased blood cholesterol levels
• All omega 3 fatty acids will benefit my heart

Fats are vital to our health and much more complicated than most people think.....
Programme

Introduction: Fats and Cardiovascular Health
Trans Fats – do they still pose a risk?
What to we really know about Sat Fats?
Are all PUFAs good for me?
Marine Omega 3 Fatty Acids and Cardiovascular Health - A case of myths, mysteries, misunderstandings and missed opportunities? Can they do more for my health?

My Dad......

Dr Robert S Winwood – Senior Cardiologist, St Bartholomew's Hospital, London.
Despite eating less fat, Britain is becoming dangerously obese

Levels of obesity in the UK have almost doubled since the early 1990s, Yet intake of total fat and sats fats decreased!

In 2014, Cardiovascular disease accounted for 28% of deaths in men and 26% in women.

Source: British Heart Foundation report on Cardiovascular Disease 2015

In 2017, there is still widespread nutritional ignorance about fat!
And future for our children looks grim.....

- In the 1960s, less than 1% of school children were obese in the UK
- In 2016, 22% of children in their first registration class are obese,
- And 33% of school children in year 6.

- Obesity-related hospital admissions for children have almost doubled in the past 10 years

- The government Eatwell guide does not reflect current eating habits.
- Consumption of refined sugars is over double that recommended.
Basic Fat Structural Chemistry

**TYPES OF FATTY ACIDS**
(according to the number of double bonds)

- Saturated (No bond)
- Monounsaturated (1 bond)
- Polyunsaturated (>1 bond)

Types of fatty acids:
- Saturated triglyceride
- Unsaturated triglyceride
- Stearic acid (saturated)
- Elaidic acid (trans-unsaturated)
- Oleic acid (cis-unsaturated)
FAT IS ESSENTIAL FOR LIFE (1)

- FAT is an ESSENTIAL MACRONUTRIENT and a reservoir of energy
- 12-14% of a HEALTHY new born baby’s birthweight is FAT
- THE FATS we consume are PREDOMINANTLY in the form of TRIGLCYERIDES: 3 FATTY ACIDS esterified onto glycerol. The types of fatty acid and where they are positioned are IMPORTANT
- FAT is a SOURCE of many thousands of metabolites essential for the smooth running of our bodies
- FAT provides structural cushioning for all our essential organs
- DIETARY FAT provides an important source of FAT SOLUBLE VITAMINS (A, D, E and K).
- Our BRAINS are ca. 60% FAT (on a dry weight basis) utilises 20% of our energy intake. Glucose is the main energy source, BUT excess leads to obesity. Ketogenesis of medium chain saturated fatty acids is the default mode of energy production in humans (c8:0, c10:0, c12:0)
- Adherence to a NO FAT and VERY LOW FAT DIETS soon leads to adverse health consequences
FAT IS ESSENTIAL FOR LIFE (2)

- MODERATE Consumption of naturally derived fats IS good for your health AND will not increase your risk of cardiovascular disease or cancer
- The HUMAN BRAIN. Myristic acid (C14:0) is essential for myelination of nerve fibres
- A recent meta analysis ha shown that studies available at the time of the introduction of the US 1977 & UK 1983 DIETARY FAT GUIDELINES did not justify their contents (Harcombe Z et al., Open heart 2015).
Current Fat types definition paradigm

<table>
<thead>
<tr>
<th>Type</th>
<th>Traditional view</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trans Fats</td>
<td>Ugly (v bad)</td>
<td>Man made or dairy</td>
</tr>
<tr>
<td>Sat Fats</td>
<td>Bad</td>
<td>Animals fats/coconut</td>
</tr>
<tr>
<td>MUFAs</td>
<td>Goodish</td>
<td>Olive oil</td>
</tr>
<tr>
<td>PUFAs</td>
<td>Good</td>
<td>Seed oils/Fish Oils</td>
</tr>
</tbody>
</table>
Cardiovascular Disease

Examples of Risk Factors:
• Stress
• Smoking
• Obesity,
• Sedentary lifestyle
• Dyslipidemia
• Hypertension
• Genetic predisposition
• Metabolic syndrome
• Poor diet (high salt/trans-fats)
• Infection

CVD is a multi-factorial disease.
The efficacy of any nutritional intervention thus needs to be determined by a relevant basket of validated biomarkers

Proven treatment interventions:
• Exercise
• Reduce blood pressure
• Regularise blood lipid profile
• Reduce inflammation
• Reduce blood viscosity/clotting
Nutrition and heart health

Nourish your heart

• Small dietary changes can lead to a large reduction in the burden of CVD

• Improving your diet is a key factor in preventing and managing cardiovascular diseases

• Numerous scientific studies showed that nutrients can reduce the risk of CVD and promote a healthy heart

• Nutritional epidemiology showed that specific nutrients play a key role in maintaining a healthy heart

Source: International Osteoporosis Foundation www.iofbonehealth.org
Why some fats were thought good and others bad...

Changes in Good (HDL) & Bad (LDL) Cholesterol Relative to carbohydrates

If we remove Sat Fats from the diets, we need to replace it with something.

Sourced from a presentation by Dr Peter Zock at Lipids and Health 2015

Nutrition intervention studies show that replacing 5%E of SFA with PUFA is estimated to lower LDL cholesterol by 0.25 mmol/L (~7%)

Observational studies show that
- Replacement of SAFA by PUFA is beneficial
- Replacement of SAFA by carbohydrates: not significant different
- Replace SAFA by MUFA: not significant (even seems adverse, may be due to TFA)

But this benefit assumes lower cholesterol reduces CVD risk in healthy individuals.

Sourced from a presentation by Dr Peter Zock at Lipids and Health 2015

Pooled analysis of 11 high-quality cohort studies

Change in CHD Risk for Each 5% Energy

SAFA → PUFA
SAFA → Carb
SAFA → MUFA

Total of 344,696 individuals with 5,249 CHD events. *p<0.05

1 PUFA being a mix of mainly omega-6 + some omega-3

Jakobsen et al, AJCN 2009
Current NHS advice on Saturated Fat Intake

Current NHS advice is ‘to eat less saturated fat or swap foods high in saturated fat for smaller amounts of foods containing unsaturated fats, to reduce the health risks linked with high cholesterol levels’.

• Yet cholesterol levels are minimally (if at all) effected by diet in healthy people.
• Cholesterol is only one of many biomarkers that should be considered when assessing the risk of cardiovascular disease.
• The basis of Saturated Fats being a risk is on the basis it raises LDL cholesterol in the blood. Yet a series of recent studies, and reworking of much older studies, suggest that there is no association between sat fats intake and CVD.
Danish fat tax had a ‘small but positive impact’ on the nation’s health

By Niamh Michall+
27-Apr-2016
Last updated on 27-Apr-2016 at 16:10 GMT

Denmark’s short-lived tax on saturated fat had a small but positive impact on the nation’s health, cutting consumption of total fat and boosting vegetable and fibre intake – although it also had the unintended effect of increasing salt intake among women, say researchers.

In October 2011 Denmark became the first country in the world to impose a tax on saturated fat. Although short-lived - it scrapped by the successive government in January 2013 - researchers from the University of Copenhagen and Oxford say it nevertheless improved the Danish diet, saving an estimated 123 lives per year.

BUT the researchers calculate this using a model that assumes less sat fat = less cholesterol = less heart attacks
Timelines for the introduction of Dietary Fats Guidelines

<table>
<thead>
<tr>
<th>Year</th>
<th>Government advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>Dietary Goals for the USA</td>
</tr>
<tr>
<td>1980</td>
<td>Dietary Guidelines for Americans</td>
</tr>
<tr>
<td>1983</td>
<td>Proposals for nutritional guidelines for health education in Britain (NACNE)</td>
</tr>
<tr>
<td>1984</td>
<td>Diet and cardiovascular disease policy paper (COMA)</td>
</tr>
</tbody>
</table>

But the message had totally changed:

- **From:** “Farinaceous and vegetable foods are fattening, and saccharine matters are especially so.” (Tanner 1869 – page 213)
- **To:** “Base your meals on starchy foods.” (UK gov. 1984)
  “The previous nutritional advice in the UK to limit the intake of all carbohydrates as a means of weight control now runs counter to current thinking and contrary to the present proposals for nutrition education policy for the population as a whole... The problem then becomes one of achieving both a reduction in fat intake to 30% of total energy and a fall in saturated fatty acid intake to 10%.”

Sourced from the presentation of Dr Zoe Harcombe at Lipids and Health 2015
Dr Ancel Benjamin Keys 1904-2004
Father of the Diet Heart Theory

Devised the K rations for US troops in WW2

Author of the famous Seven Countries Study.

First proposed the Diet-Heart Hypothesis.

Produced the Keys equation: for every 1% increase in sat fat intake, blood cholesterol rises 2.7 mg/dL.

From 1955-58 Keys looks at dietary intake and blood cholesterol levels in 13,000 men around the globe aged 40 to 59 years.
Seven Countries Study, Keys J Mount Sinai Hospital 20, 1953

Fat consumption v Mortality
But 20 + Countries from the same period......
Yerushalmy & Hilleboe, NY State J Med 1957

The correlation disappears!
Heart Disease in the UK during wartime rationing 1940-53

- For 12 years, saturated fat consumption was severely restricted
- Fruit and vegetable consumption increased
- The rate of heart disease almost trebled!!!
President Dwight Eisenhower has a heart attack in 1955.

He thinks dietary cholesterol and sat fats are the cause - and develops a profound belief that diet could prevent a further episode.

He initiates research into fats and CVD ably assisted by the large vegetable oil producers.

From 1950 to 1972 margarine consumption doubles in the USA, from 1956 to 1976, butter consumption halves.
"The evidence - both from experiments and from field surveys - indicates that cholesterol content, per se, of all natural diets has no significant effect on either the cholesterol level or the development of atherosclerosis in man." (Keys 1955)
Sat Fats are replaced by deadly Trans Fats

Senator George McGovern (Presidential candidate 1972)

First-ever director of the United States’ Food for Peace program in 1961

1977 Senator George McGovern produces First Dietary Goals for the USA


1980 Hegstead and McGuinness produce “Dietary Guidelines for the USA” which state “Fat and cholesterol should be avoided!

Max 30% Fat, Max 10% Sats, replace Sats with PUFAs.
“Sat Fats are nutrients – not poisons”, Prof Legrand, INRA

- All Sat Fats provide energy
- Some Sat Fats have specific physiological functions
- The human body makes its own sat fats
- Some sat fats are not stored by the body, hence a constant source is required e.g. myristic acid.
- In France, the nutritional advice is a maximum of 12% of caloric energy should be Sat Fats, but of this no more than 8% should be lauric, myristic or palmitic acid.

TRANS FATS
Sources of Trans Fats

Two types:

- Natural: Formed by Biohydrogenation i.e. produced in the rumen of animals. Found widely in dairy products.

- Synthetic: Formed by partial hydrogenation i.e. produced using heat, pressure and a catalyst applied to vegetable and fish oils.

- Synthetic trans fats are formed during the process of hydrogenation used to liquid vegetable and fish oils more solid! The process was invented by Wilhelm Normann in 1901 in Herford, Germany.

- They were widely used in margarines and frying oil. Today, their use is largely restricted to imitation chocolate and other bakery toppings.
Trans Fats and Health

• Industrial Trans fats not only adversely effect blood cholesterol, but accumulate to unknown effect in brain, muscle and adipose tissue. They adversely effect red and white blood cell function and glucose/insulin metabolism.

• Natural dairy trans fats are present in human breast milk and may have an essential role in the development of the immune system in infants. Their consumption does not appear to have adverse effects in adults.
Mary was an early researcher of trans fatty acid, warning of their dangers before they were widely accepted in the early 1990’s.

She pushed for improved labelling of trans fats on products, which is now mandatory on food products in the U.S. and in Europe. (Typical suggested dietary maximum is 1 – 2% of calories)


Webb, Densie (September 5, 1990). "Processed oils rival butter in raising cholesterol". Wilmington Morning Star..
A natural trans fat, Vaccenic Acid which is present in human breast milk, which could aid the health and development of formula fed babies

Vaccenic Acid (VA)
11 trans octadecenoic acid (C18:1 trans 11)
Naturally occurring trans fat in dairy products.
Pre-cursor of CLA (conjugated linoleic acid)
Typically present in human breast milk at ca 0.4% of total lipids
Recent evidence that VA helps prevent allergic responses in children under 2 years of age
(Thijs et al, 2011, Allergy Jan: 66(1)58-67)
Could be extracted and concentrated from ruminant milk products for addition to formula
SAT FATS
RCT evidence at the time

“Evidence from randomised controlled trials did not support the introduction of dietary fat guidelines in 1977 and 1983: A systematic review and meta-analysis”

Dietary Intervention & All deaths

<table>
<thead>
<tr>
<th>Study name</th>
<th>Risk ratio</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rose Corn Oil (1965)</td>
<td>4.643</td>
<td>0.580</td>
<td>37.149</td>
<td>5 / 28</td>
<td>1 / 26</td>
</tr>
<tr>
<td>Rose Olive Oil (1965)</td>
<td>3.000</td>
<td>0.333</td>
<td>26.992</td>
<td>3 / 26</td>
<td>1 / 26</td>
</tr>
<tr>
<td>Research Committee Low-Fat (1965)</td>
<td>0.874</td>
<td>0.510</td>
<td>1.499</td>
<td>20 / 123</td>
<td>24 / 129</td>
</tr>
<tr>
<td>MRC Soybean Oil (1968)</td>
<td>0.881</td>
<td>0.550</td>
<td>1.411</td>
<td>28 / 199</td>
<td>31 / 194</td>
</tr>
<tr>
<td>LA Veterans Dayton (1969)</td>
<td>0.978</td>
<td>0.834</td>
<td>1.148</td>
<td>174 / 424</td>
<td>177 / 422</td>
</tr>
<tr>
<td>Leren, Oslo heart study (1970)</td>
<td>0.935</td>
<td>0.773</td>
<td>1.131</td>
<td>101 / 206</td>
<td>108 / 206</td>
</tr>
<tr>
<td>Woodhill, Sydney heart study (1978)</td>
<td>1.494</td>
<td>0.953</td>
<td>2.342</td>
<td>39 / 221</td>
<td>28 / 237</td>
</tr>
<tr>
<td></td>
<td>0.996</td>
<td>0.865</td>
<td>1.147</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Risk ratio and 95% CI

Favours Intervention Favours Control

Meta Analysis random effects method

Evidence from randomised controlled trials did not support the introduction of dietary fat guidelines in 1977 and 1983: a systematic review and meta-analysis

Zöli Harcombe.¹ Julien S Baker,¹ Stephen Mark Cooper,² Bruce Davies,³ Nicholas Sculthorpe,⁴ James J DiNicantonio,⁴ Fergal Grane⁴

US government
Recommended
Max 30% fat
Max 10% Sat Fats

Sourced from the presentation of Dr Zoe Harcombe at Lipids and Health 2015
So in 1983 these studies were used for max 30% fat, max 10% sats dietary guidelines

Recommendations were made for 276m people following 6 secondary studies of 2,467 males.
No study recommended change.
RCT evidence did not support the introduction of dietary fat guidelines.

Sourced from the presentation of Dr Zoe Harcombe at Lipids and Health 2015
And a meta-analysis of recent studies of death from CVD in relation to fat consumption – again shows no effect!

The evidence from these recent randomised controlled trials does NOT support current dietary fat guidelines

Sourced from the presentation of Dr Zoe Harcombe at Lipids and Health 2015
### Summation of evidence re replacing Sat Fats, Mozaffarian 2010

#### Dietary Change (each 5% energy)

<table>
<thead>
<tr>
<th>Type of Change</th>
<th>Effect from TC:HDL Change</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUFA Replacing SFA</strong></td>
<td>Predicted Effect from TC:HDL Change</td>
<td>0.91 (0.87, 0.95)</td>
</tr>
<tr>
<td></td>
<td>The Present Meta-Analysis of 8 RCTs</td>
<td>0.90 (0.83, 0.97)</td>
</tr>
<tr>
<td></td>
<td>Pooled Analysis of 11 Observational Cohorts</td>
<td>0.87 (0.77, 0.97)</td>
</tr>
<tr>
<td><strong>Carbohydrate Replacing SFA</strong></td>
<td>Predicted Effect from TC:HDL Change</td>
<td>1.01 (0.98, 1.04)</td>
</tr>
<tr>
<td></td>
<td>Results from WHI RCT</td>
<td>0.98 (0.88, 1.09)</td>
</tr>
<tr>
<td></td>
<td>Pooled Analysis of 11 Observational Cohorts</td>
<td>1.07 (1.01, 1.14)</td>
</tr>
<tr>
<td><strong>MUFA Replacing SFA</strong></td>
<td>Predicted Effect from TC:HDL Change</td>
<td>0.93 (0.89, 0.96)</td>
</tr>
<tr>
<td></td>
<td>RCTs – None</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Pooled Analysis of 11 Observational Cohorts</td>
<td>1.19 (1.00, 1.42)</td>
</tr>
</tbody>
</table>

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**Sourced from a presentation by Dr Peter Zock at Lipids and Health 2015**
The percentage of daily calorie intake delivered by total fat is **not** related with risk of:

- Heart disease
- Cancer
- Type 2 diabetes

And it is also **not** the main cause of weight gain and obesity

The scientific evidence is consistent that:

*Higher PUFA intakes reduce the risk of coronary heart disease*

* PUFA being a mix of mainly omega-6 + some omega-3*
Saturated fat does not clog the arteries: coronary heart disease is a chronic inflammatory condition, the risk of which can be effectively reduced from healthy lifestyle interventions

Aseem Malhotra,¹ Rita F Redberg,²,³ Pascal Meier⁴,⁵

Figure 1  Lifestyle interventions for the prevention and treatment of coronary disease.
PUFA’S AND ESSENTIAL FATTY ACIDS
The NUTRITION TEXT BOOKS TELL YOU Linoleic ACID (LA) and ALPHA LINOLENIC ACID (ALA) ARE ESSENTIAL, BUT:-

The “ESSENTIALITY” of any fatty acid is determined by its effect on a Linoleate starved mouse. Most of this work was conducted in the 1950’s.

DEFICIENCY symptoms of LA and ALA have only been seen in a handful of tube FED (parenteral) severely ill patients.

DEFICIENCY is avoided when the diet contains more than 0.5% LA (as total energy), most western diets contain 5 -10%

The textbooks say LA and ALA cannot be synthesized by the human body, but recent work with radioactive tracers shows that sufficient LA can be made from ARA and sufficient ALA from EPA and DHA by retro-conversion.

LINOLEIC acid intake is promoted as HEART HEALTHY, but modern reworking of original human feeding trials (Sydney diet health study and Minnesota Coronary Experiment: Ramsey CE et al, 2014 & 2016 BMJ ) appear to suggest an increased risk of CVD , particularly in older women.

ALPHA LINOLENIC ACID is derived primarily from oilseeds and is an omega 3 fatty acid, and can be labelled on foods in the UK as such, BUT unlike its marine cousins EPA And DHA, it does not have EFSA APPROVED HEALTH CLAIMS.
Two recent studies reworking old data on studies used to promote PUFA use by Ramsden et al cast doubt on the cardiovascular benefits of vegetable oils.

BMJ 2016. Uses total data from a large scale study composed at Ancel Keys own facility.

Sydney Diet Heart Study 1966-73

Involved 458 men aged 30-59 who had experienced a previous heart attack at a Sydney Coronary Care centre.

The Sat Fats in the diet were replaced with Safflower Oil (ca 75% linoleic acid) in a margarine. The Linoleate intake increased from ca 7 to 15%, replacing sat fats.

The original study report in 1978 indicated increased mortality in the Safflower group but did not comment of cardiovascular events.

The reworked study showed clearly that there was a significant increase in adverse cardiovascular events and cardiovascular mortality in the Safflower intervention group.

The conclusion was that the long held Diet-Health Hypothesis had been disproved in this case.
Minnesota Coronary Experiment (MCE) 1968-1973

9,423 participants were fed a high linoleate diet, replacing sat fats. The original report written in 1989 reported no effect in terms of heart attacks or cardiac deaths, though blood cholesterol levels were significantly reduced.

Using recovered autopsy reports, the Ramsden team showed the corn oil intervention group had increased risk. In women over 65, this risk of heart attacks or cardiac death was 15% more than their control group counterpart.
A meta-analysis of all Sat Replacement trials by Ramsden et al, 2016

<table>
<thead>
<tr>
<th>Trial and intervention</th>
<th>Hazard ratio (95% CI)</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Main analysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCE - linoleic acid</td>
<td>1.12 (0.78 to 1.62)</td>
<td></td>
</tr>
<tr>
<td>SDHS - linoleic acid</td>
<td>1.74 (1.04 to 2.91)</td>
<td></td>
</tr>
<tr>
<td>RCOT - linoleic acid</td>
<td>4.64 (0.58 to 37.15)</td>
<td></td>
</tr>
<tr>
<td>LA Vet - linoleic acid + ALA</td>
<td>0.82 (0.56 to 1.21)</td>
<td></td>
</tr>
<tr>
<td>MRC-Soy - linoleic acid + ALA</td>
<td>0.97 (0.58 to 1.64)</td>
<td></td>
</tr>
<tr>
<td>Overall: $I^2=45%$, P=0.121</td>
<td>1.13 (0.83 to 1.54)</td>
<td></td>
</tr>
<tr>
<td><strong>Sensitivity analysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCE - linoleic acid</td>
<td>1.12 (0.78 to 1.62)</td>
<td></td>
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<tr>
<td>DART - LA + ALA</td>
<td>1.00 (0.76 to 1.30)</td>
<td></td>
</tr>
<tr>
<td>ODHS - LA+EPA/DHA</td>
<td>0.74 (0.51 to 1.08)</td>
<td></td>
</tr>
<tr>
<td>STARS - LA+EPA/DHA</td>
<td>0.35 (0.04 to 3.12)</td>
<td></td>
</tr>
<tr>
<td>Overall: $I^2=38%$, P=0.130</td>
<td>1.00 (0.81 to 1.24)</td>
<td></td>
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</tbody>
</table>
Virtanen JK et al 2017, Eur J Clin Nutr Post Hoc study does not find Omega 6 fatty acids are inflammatory in CVD

- In their recent paper, “The associations of serum n-6 polyunsaturated fatty acids with serum C-reactive protein in men: the Kuopio Ischaemic Heart Disease Risk Factor Study”, a post hoc study of a cohort of 1267 healthy Finnish men from 1984-89 found no association between Omega 6 PUFAs and C reactive protein.

- Cardiovascular disease is normally associated with inflammation. A common marker used for this inflammation are the levels of C reactive protein.

- Whilst encouraging, more recent data from much larger studies in other populations are required to confirm these findings.
YOUR BODY NEEDS OMEGA-3

**ALA**  Alpha-linolenic
*Primarily from flax (linseed) / canola (rapeseed)*

**EPA**  Eicosapentaenoic Acid
*Primarily from fish*

**DHA**  Docosahexaenoic Acid
*Primarily from fish / algae*

*majority of science for heart, brain health and normal growth & development*
OMEGA-3: A LIFETIME OF BENEFITS

Ongoing Research

Infant Eye & Brain development

- Eye Health
- Heart Health
- Joint Health
- Cognition
- Inflammation
- Cancer (some types)

- DHA
- EPA
- DHA
- EPA
- DHA
- EPA
- DHA
- EPA
- DHA
- EPA
- DHA
- EPA

**Disclaimer: Not for purposes of claims**
Omega-3 Fatty Acids Are Not The Same
METABOLIC PATHWAY FOR FORMATION OF ARA, EPA AND DHA

**Omega-6**
- Component of Neural Tissue
- Supports growth
- Supports immune function

**Shared**
- 18:2 (LA)
- 18:3 (GLA)
- 20:3 (DGLA)
- 20:4 (ARA)
- 22:4
- 24:4
- 24:5
- 22:5 (DPA) \( \Omega 6 \)

**Omega-3**
- \( \Delta 6 \)-desaturase
- \( \Delta 5 \)-desaturase
- Elongase

**Shared**
- 18:3 (ALA)
- 18:4
- 20:4
- 20:5 (EPA)
- 22:5 (DPA)
- 24:5
- 24:6
- 22:6 (DHA) \( \Omega 3 \)

**Supports**
- Cardiac function
- Component of Neural Tissue
- Visual & cognitive development
- Cardiac function

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IMPORTANT TO ‘RE-BALANCE’

Hunter/Gatherer

Agriculture

1900 initial industrialized food system = complete imbalance

1970 completely industrialized food system

3Ω (Ω3)

6Ω (Ω6)
RISK OF SUDDEN DEATH DECLINES WITH HIGHER LEVELS OF OMEGA-3

Physician’s Health Study
NEJM 2002
346(15), 1113-1118

Relative Risk of Sudden Cardiac Death

<table>
<thead>
<tr>
<th>LC-Omega-3 in Blood (%)</th>
<th>100%</th>
<th>50%</th>
<th>20%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.21 - 4.32</td>
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90% Risk Reduction
40% REDUCTION IN SUDDEN DEATH WITH FISH OIL SUPPLEMENTS

GISSI Prevenzione: landmark study confirming the cardioprotective effects of EPA+DHA

100% (Control)  
-20%  
-40%

Overall Mortality  
Sudden Death

Lancet 1999; 354:447-455
SO WHY IS THERE CONTRADICTORY INFORMATION ON THE HEALTH BENEFITS OF MARINE OMEGA 3 FATTY ACIDS?
Is the Greenland Inuit diet really that healthy?

But, over the past 40 years, the shift from traditional to western lifestyle in Greenland has increased the risk factors for cardiovascular disease. The traditional diet has been replaced by imported foods. Traditional hunting and fishing, has been replaced by sedentary income-based employment.

Source: Hudson Resources Inc. WHITE MOUNTAIN ANORTHOSITE PROJECT GREENLAND June 2014 Report No. 14-1166-0003
The Meta-analysis – and its limits!

This is a technique is regarded as the gold standard of scientific evidence, but actually has many flaws……

It uses complex statistics to combine the results of many clinical trials and population studies. The much larger combined study population should give much better believe-ability or power to results.

But there are many limitations:-

- Often the mix of studies is very heterogeneous
- Often the populations are combinations of diseased and healthy individuals
- The technique is not sensitive enough to take account of unusual base tissue levels of a particular nutrient in a population
- Studies using single nutrients and multi-nutrients are often combined
- It is not unusual for academics involved in one or more of the trials to be authors of meta-analysis and thus have a vested interest.
- Cochrane Reviews have standardised selection criteria for the inclusion of studies. The “cut-offs” often seem irrational when applied to nutritional interventions. Many good studies are needlessly excluded and result in a seriously skewed analysis.
The classic meta-analysis problem

If you combine studies about apples and pear – you can end up with a study about pearples!

+ = ?
This meta-analysis was well designed and conducted, but the negative conclusions can be challenged:

- The authors did not follow the normal PRISMA guidelines to enable correction to multiple comparisons, leading to an excessively stringent level of significance being applied ($p < 0.0063$ rather than the usual $p < 0.05$)
- Only 5 of the included 20 studies used doses of 2g EPA + DHA or more. (The minimum dose used by EFSA for BP/TG reduction).
- The effect of other medications, including statins was not considered.
- Baseline circulating omega 3 levels were not considered.
Secondary prevention of cardiac death/MI with high dose EPA/DHA

Cardiac death
32% reduction

Sudden death
33% reduction

MI
25% reduction

Source: Prof Philip Calder of Southampton University
Positive studies continue!

Consumption of Fish Oil Providing Amounts of Eicosapentaenoic Acid and Docosahexaenoic Acid That Can Be Obtained from the Diet Reduces Blood Pressure in Adults with Systolic Hypertension: A Retrospective Analysis\(^1\text{-}^3\)

Anne M Minihane,\(^4\text{a}\) Christopher K Arman,\(^5\) Elizabeth A Miles,\(^6\) Jacqueline M Madden,\(^6\) Allan B Clark,\(^4\) Muriel J Caslake,\(^7\) Chris J Packard,\(^7\) Bettina M Kofler,\(^5\) Georg Lietz,\(^8\) Peter J Curtis,\(^4\) John C Mathers,\(^8\) Christine M Williams,\(^5\) and Philip C Calder\(^6,9\)

This 2016 paper describes a RCT where meaningful reduction in blood pressure were achieved in 312 adult men and women with systolic hypertension after an intervention of 700mg/day EPA and DHA for 8 weeks.
Marine Omega 3s give hope for some intractable clinical conditions:-

OMEGA-3 FATTY ACIDS FOR BRAIN AND SPINAL CORD INJURY
A pre-clinical perspective: neuroprotection and beyond...

Adina MICHAEL-TITUS
Professor of Neuroscience
If we are to improve the health of the British Population through modifying our fat intake, we need to:

- **Aim High!**
- **Think Big!**
- Remember the elephant in the room….

Sugar
The views expressed in this presentation are of Dr Rob Winwood’s alone and may not reflect those of current or former employers, learned societies or trade organisations with which he is associated.

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• All the speakers who presented at the SCI Lipids and Health Conference in 2015, especially: Dr Zoe Harcombe, Dr Peter Zock, Professor Jack Winkler, Professor Adina Titus-Michael, Professor Philippe Legrand, Professor Ski Chilton and Mr Eric Enig.

• To the staff of the SCI, particularly Jacqui Maguire.

• To my heroes of lipid science, particularly Professors Michael Crawford, Tom Brenna, Stewart Forsyth, Chris Ramsden, Dr Alex Richardson and Captain Joe Hibbeln.
Thank you!

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