Euroopa Maaelu Arengu Põllumajandusfond: Euroopa investeeringud maapiirkondadesse

KErn Kompetenzzentrum für Ernährung

2018/12/05 Ministry of Rural Affairs of Estonia

Trans Fatty Acids

How are they created, what are they needed for and why are they unhealthy

Dr. Eva-Maria Gokel, KErn

KErn Kompetenzzentrum für Ernährung

Summary

Part 1:

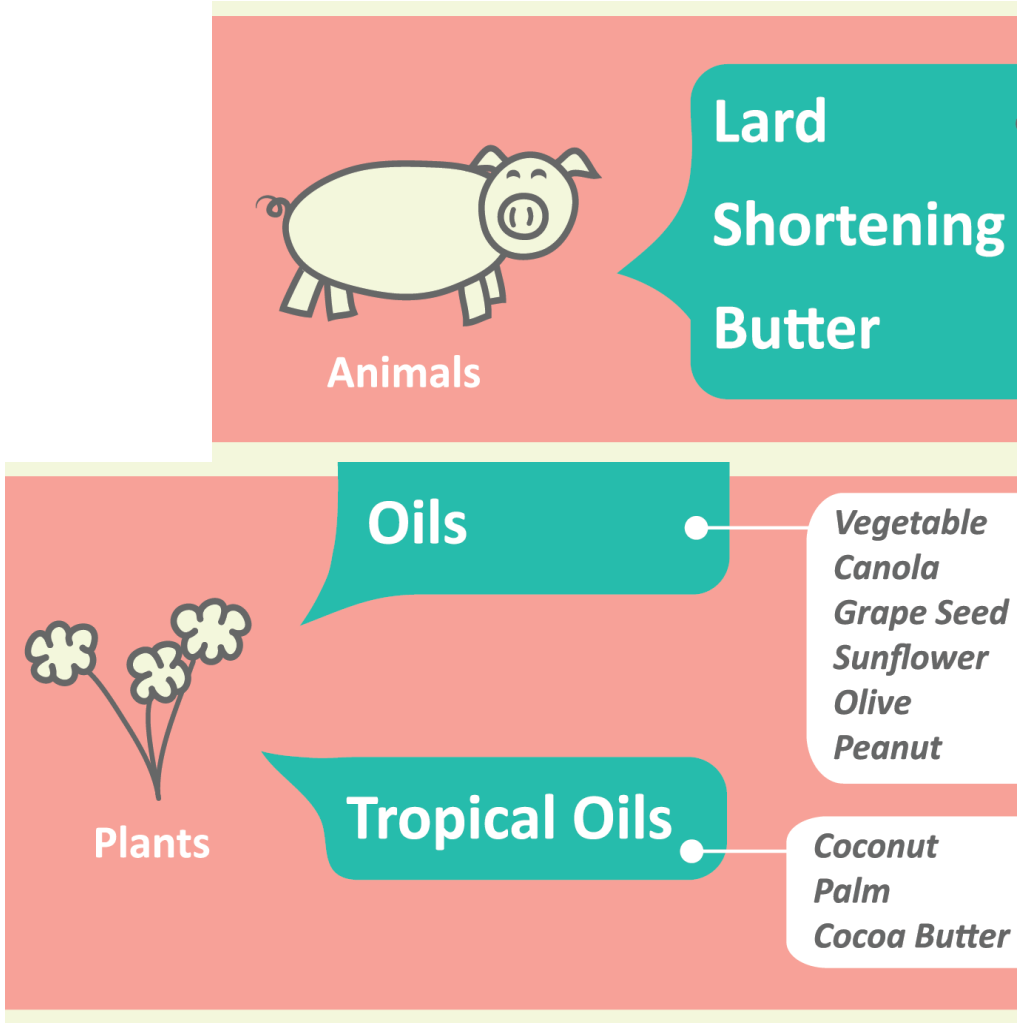
- What is Fat/ Types of Fat
- History of Trans Fats
- World wide fat-market
- Use and Benefits of Trans Fats

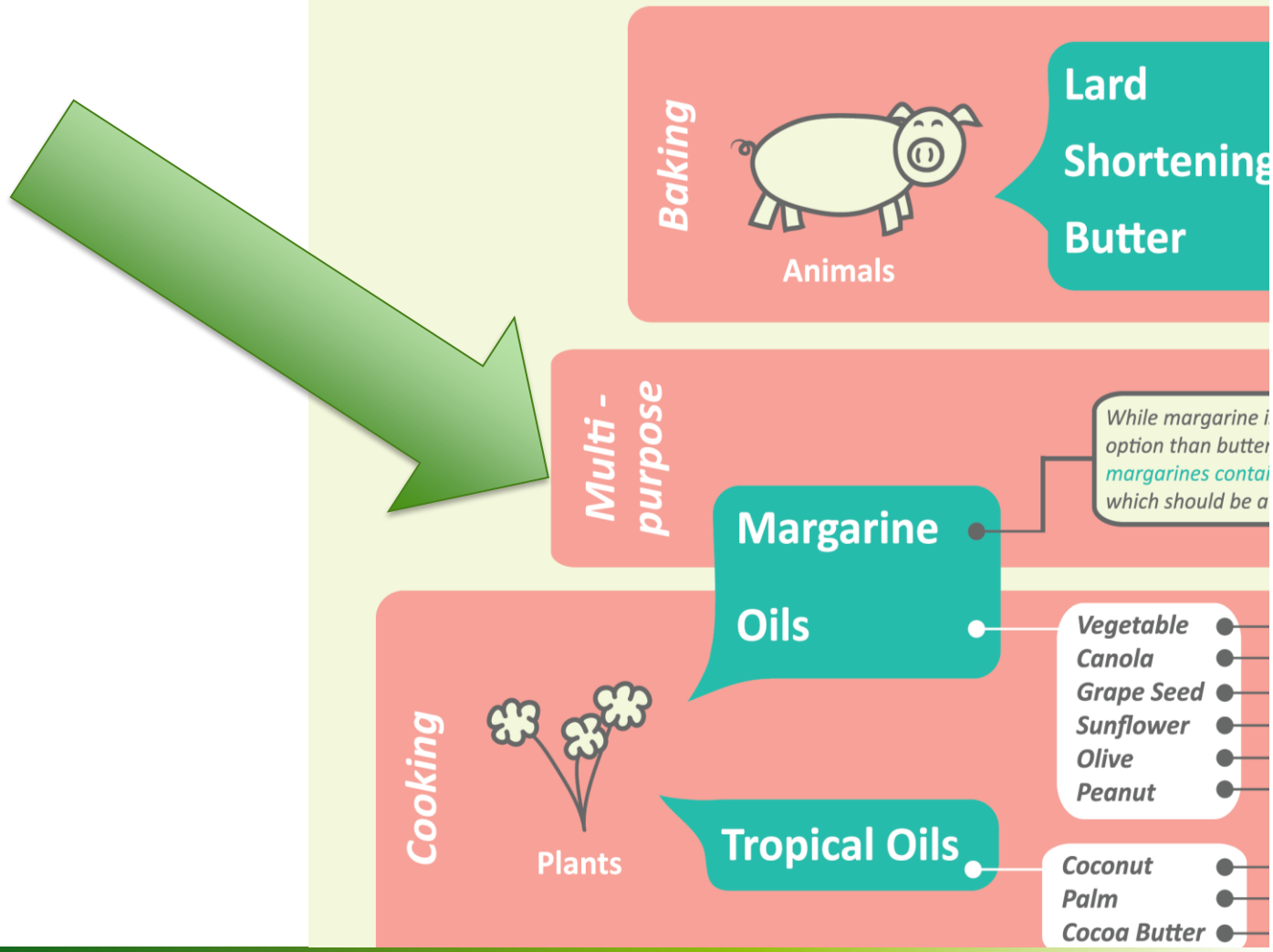
Part 2

- Trans Fats and Health Risks
- Trans Fat in the News
- What is Currently Being Done?

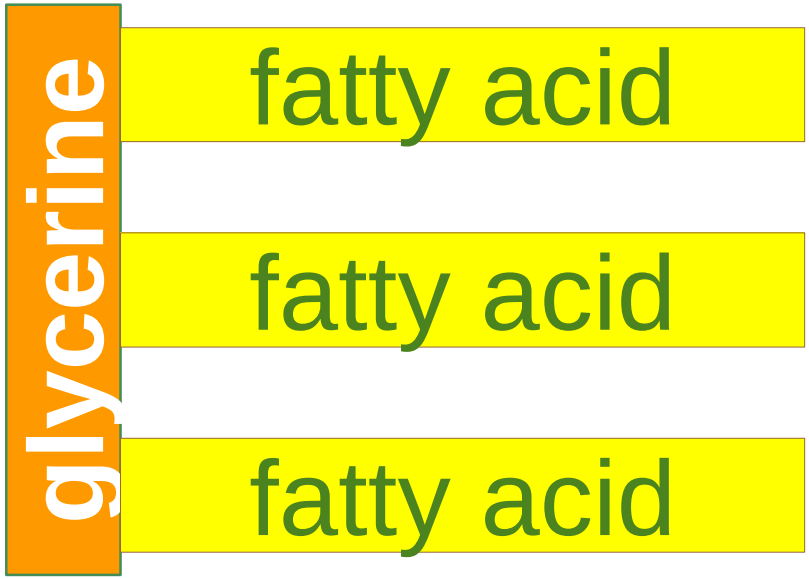
What is Fat?

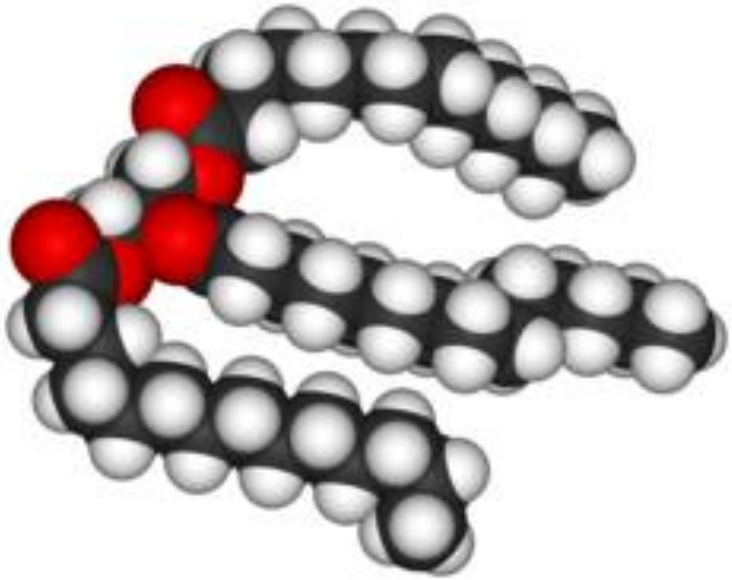
Natural sources of fat




Baking
Animals
Lard
Shortening
Butter
Multi - purpose
While margarine i
option than butter
margarines contai
which should be a
Margarine
Oils
Cooking
Plants
Vegetable
Canola
Grape Seed
Sunflower
Olive
Peanut
Tropical Oils
Coconut
Palm
Cocoa Butter

Chemistry of fats: Typical fat molecule is “E-shaped”



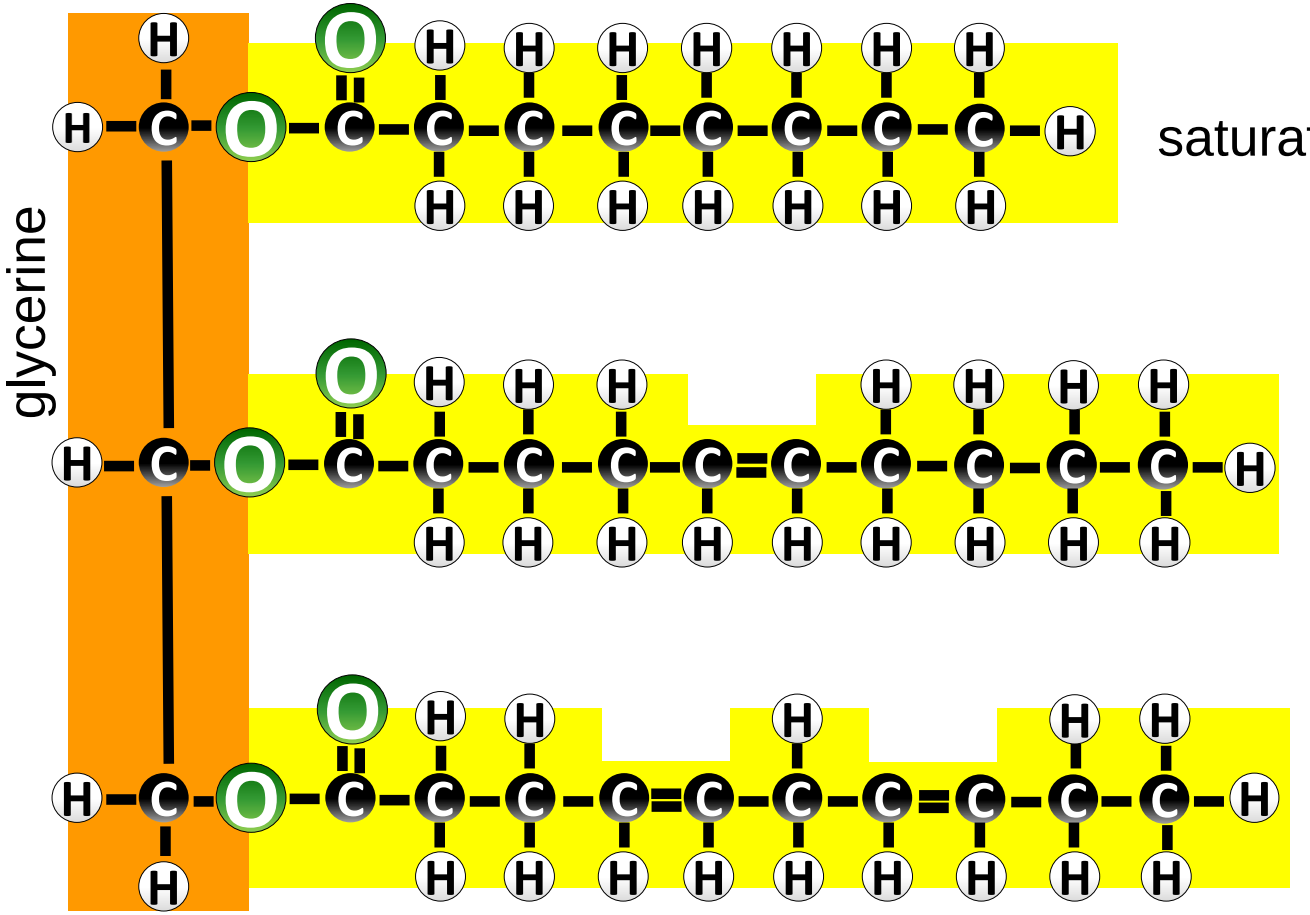


http://en.wikipedia.org/wiki/Trans_fats

Glycerol derived backbone + three fatty acid groups

(Stays constant!) (can change depending on type of fat)

Types of fat - look at the fatty acids !

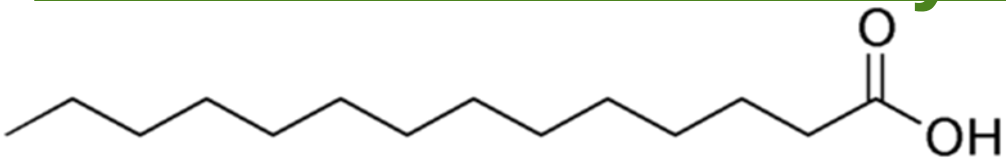


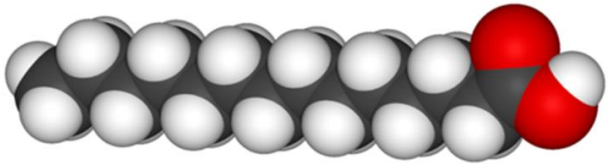
saturated fatty

monounsaturated fatty

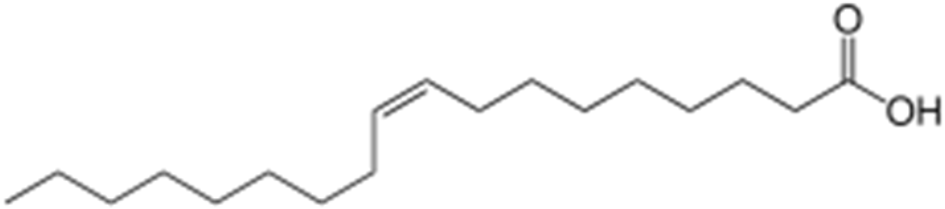
polyunsaturated fatty

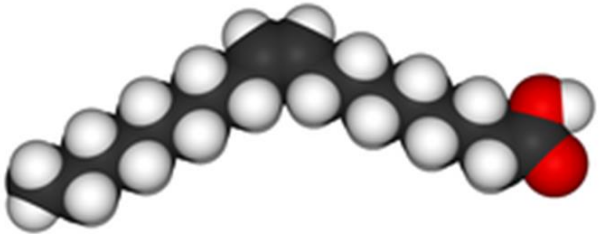
Closer look to the fatty acid chains



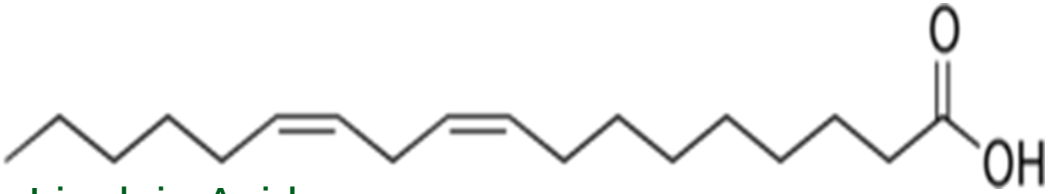


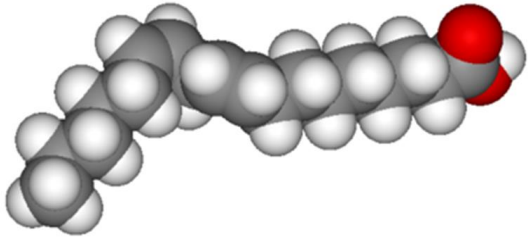
Myristic Acid (cow milk)



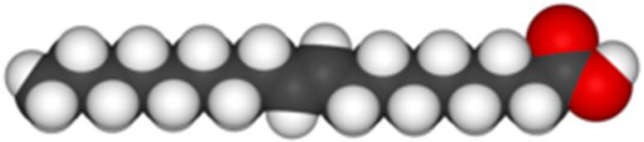


Oleic Acid (olive oil)





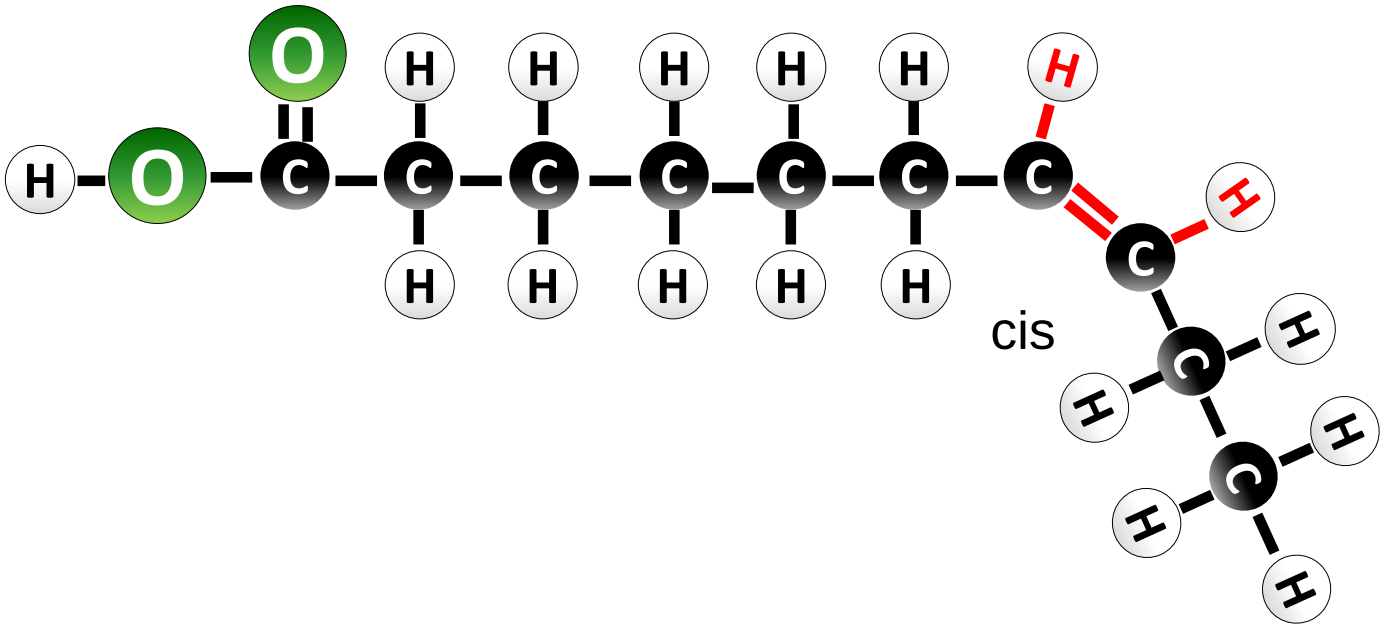
Linoleic Acid

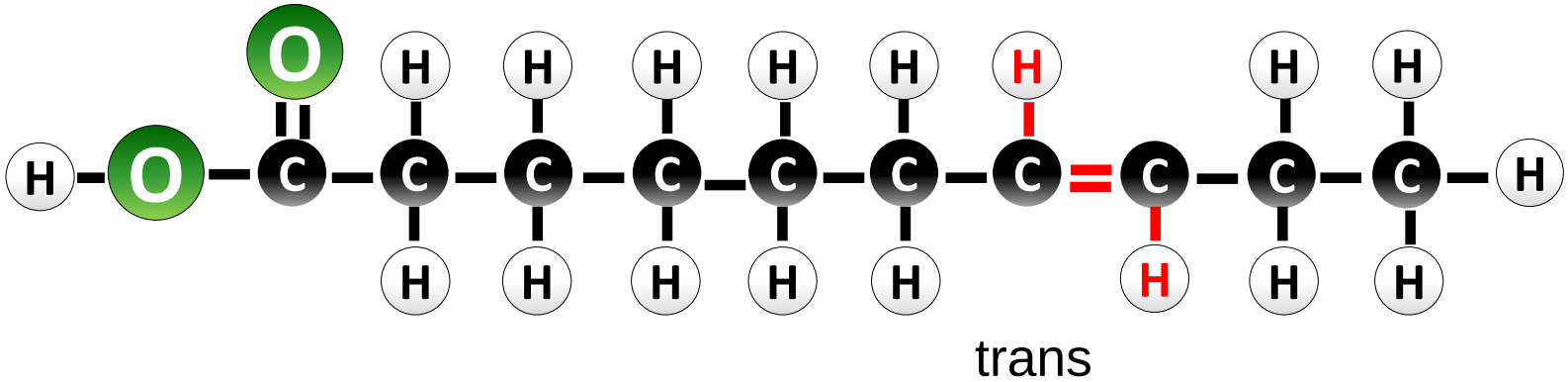


Elaidic acid, hydrogenated vegetable oils

http://en.wikipedia.org/wiki/Trans_fats

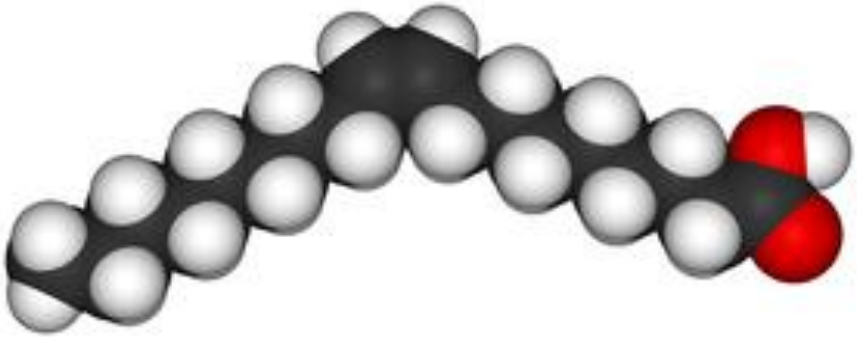
cis- and trans isomer





Trans Fat

Oleic Acid (olive oil)



Cis

Melting Point: 13.5ºC

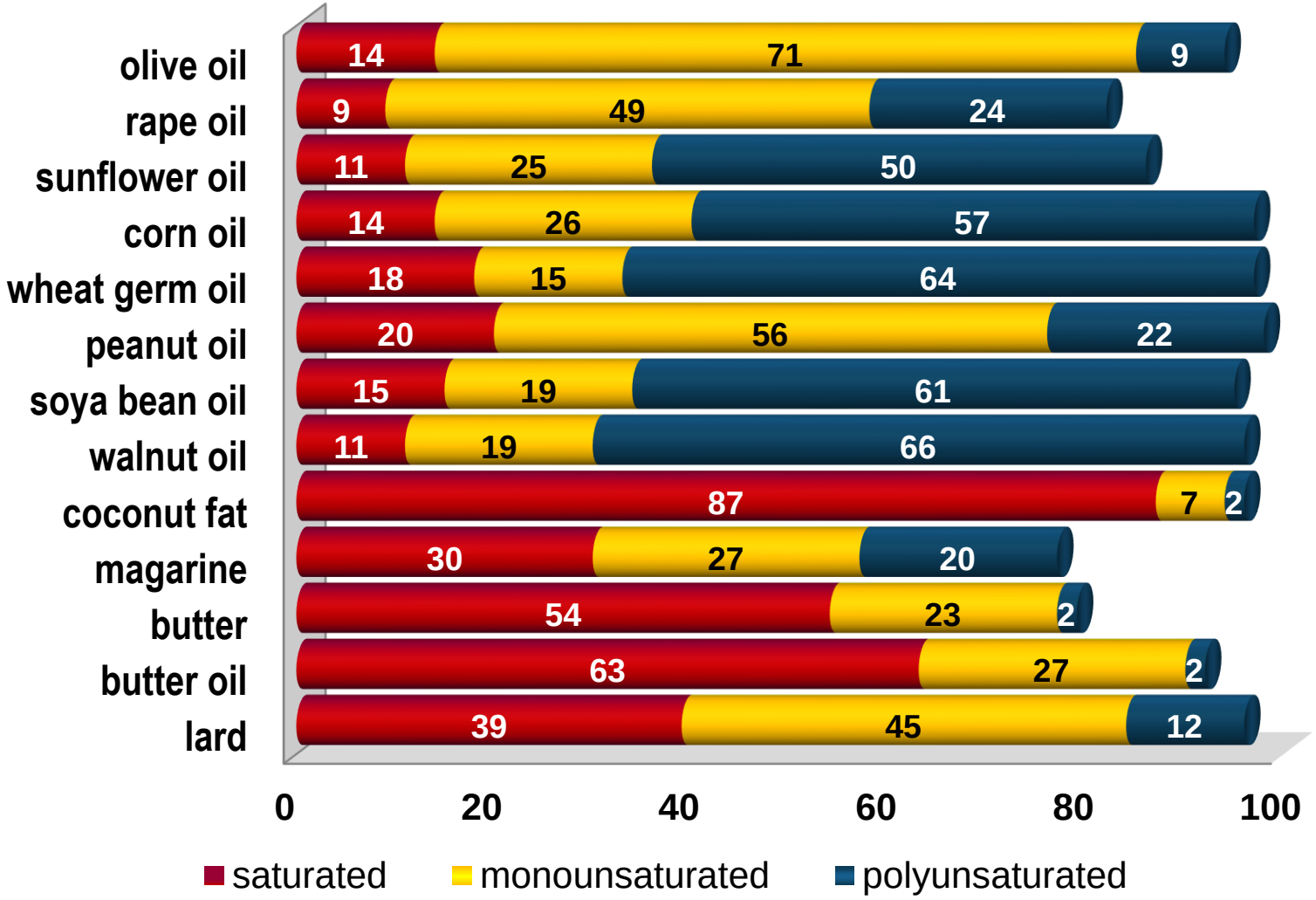
Elaidic Acid (hydrogenated vegetable oils)

Trans

Melting Point: 46.5ºC

http://en.wikipedia.org/wiki/Trans_fats

Fatty acid composition of some cooking fat in %

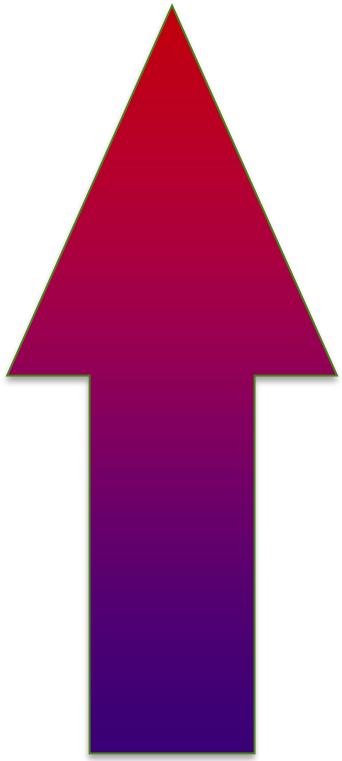


Melting point of fats

high melting temperature

long-chain fatty acids

saturated fatty acids



short-chain fatty acids

unsaturated fatty acids

low melting temperature

Trans Fat

- Type of unsaturated fat
  - Mono or poly
- Same chemical formula as many other unsaturated fats, but are in the *trans* position
  - Less fluid
  - Higher melting point

Linoleic Acid

Elaidic Acid (hydrogenated vegetable oils)

http://en.wikipedia.org/wiki/Trans_fats

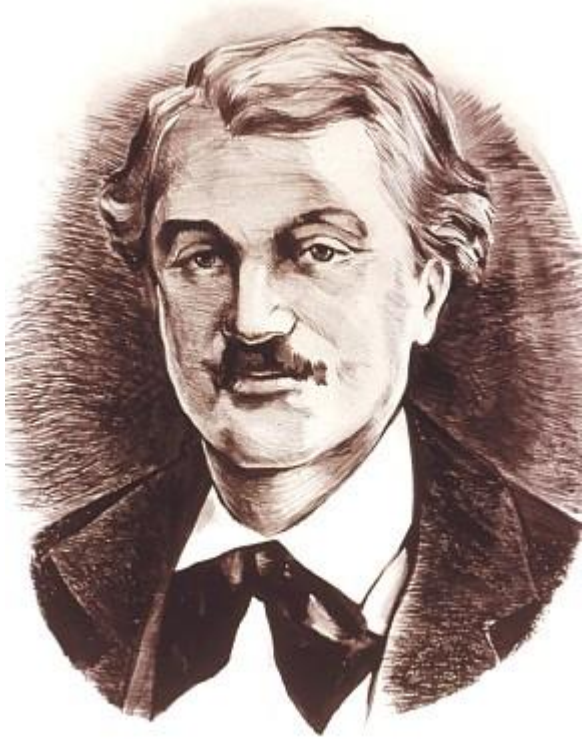
Trans Fat

- Occurs naturally in meat and dairy products from ruminants (cow, sheep, goats etc.)
- But very little amounts: up **only 2-5%** of total fat
  Conjugated linoleic acid
  - Vaccenic acid
- Trans fat in hydrogenated vegetable can be up to **45% of total fat**
  - Shortenings up to 30%
  - Margarine up to 15%
    - Some margarine is reformulated to reduce this number

Short summery / video

https://www.youtube.com/watch?v=brs2nMubr84

Hipplyte Mège-Mouriès (1817-1880)



- French chemist, focusing on fat procesing

1869 he won a prize offered by Napoleon III for a butter substitute (France was experiencing a butter shortage

1871 he sold his invention to a compnay in Holland „Jurgens," –UNILEVER

- His manufacturing method was very simple

Short video about the invention of Mège-Mouriès

https://www.youtube.com/watch?v=P3BrqMEJ9JE

Wilhelm Normann (1870 -1939)

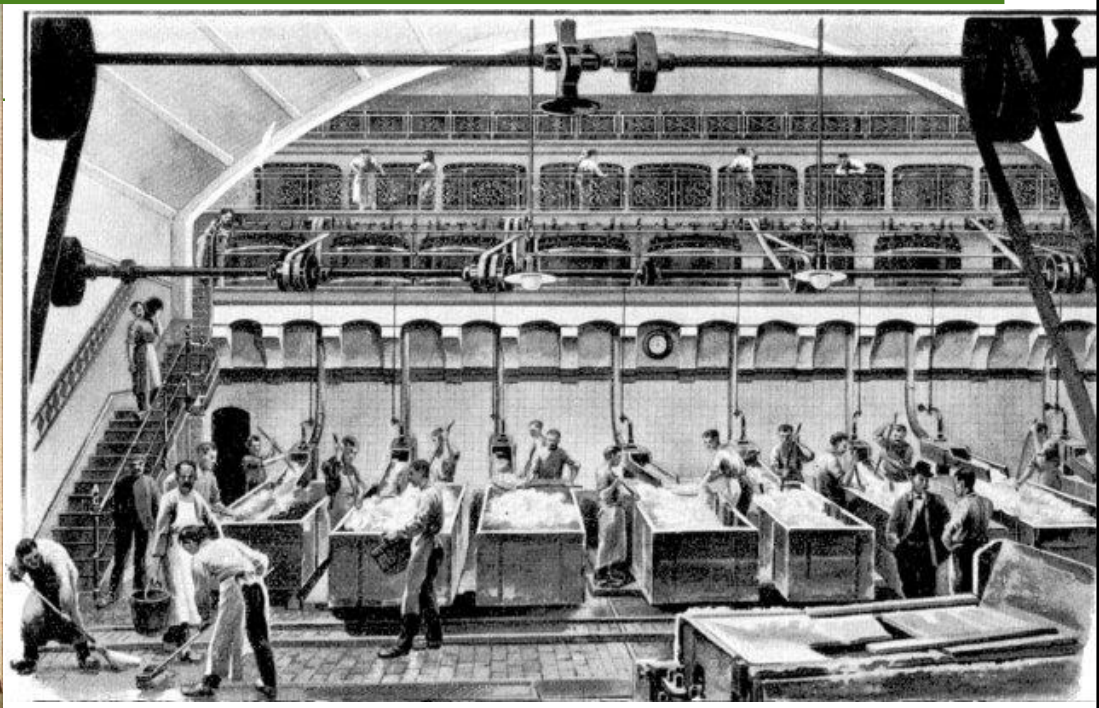
On 27 February 1901 Normann invented what he called **fat hardening,** which was the process of producing saturated fats.

On 14 August 1902 the German Imperial patent office granted patent 141,029 to the Leprince & Siveke Company,

and on 21 January **1903** Normann was granted the **British patent**, GB 190301515

"Process for Converting Unsaturated Fatty Acids or their Glycerides into Saturated Compounds".

Historical facts, end of the 20th century

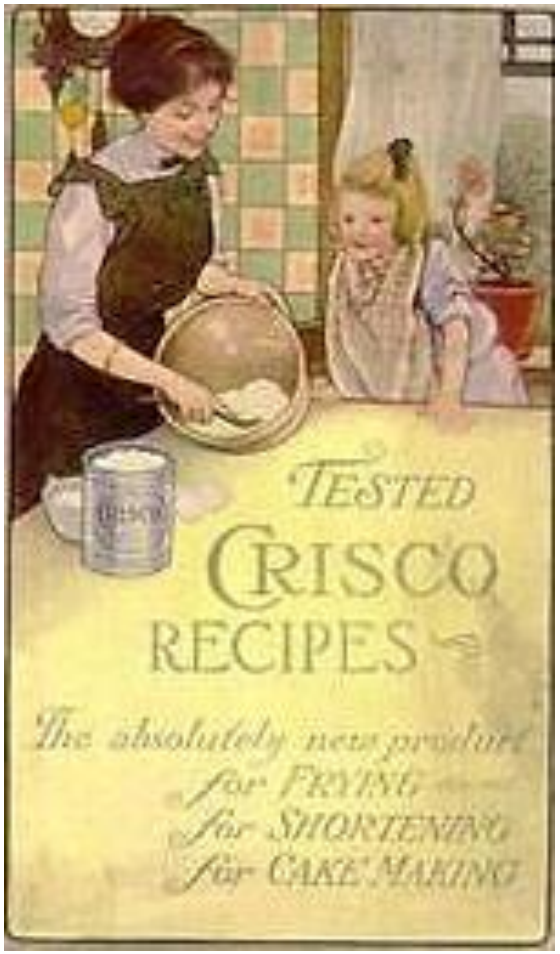


Source: https://www.kle-blatt.de/blog/kleve/die-kirnraeume-der-margarinefabrik-van-den-bergh-in-kleve.html

Source: https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTqDBZYYjDDp_IXXMROnwB8ItptVpki6PsrCiGiCRd1sh8QqLUCfQ

History of Trans Fats - USA

- 1903
  - Wilhelm Normann developed methods to hydrogenate liquid oils
  - Patented the process
- 1909
  - Proctor and Gamble bought the rights to Normann's patent
- 1911
  - P & G developed Crisco
    - First hydrogenated shortening
    - Hydrogenated cottonseed oil



Source: http://en.wikipedia.org/wiki/Trans_fats

Benefits of hydrogenating plant oils

- Decrease rancidity
- Increase shelf life
- Decrease need for refrigeration
- Form a semi-solid because of increased melting temperature
- Malleable fat melts when cooked or consumed
- Semi-solid fats are preferred **for baking** because they cause a more desirable texture in the baked products

Benefits of Trans Fats

- Can replace butter and lard
- Foods containing trans fats are considered kosher
- Can be consumed by vegans, vegetarians, and people who follow religions banning certain animal products
- **Price**

„End“ of hydrogented fats?

- Popularity of hydrogenated fats increased until 1960s
  - **Lower costs**
  - **Belief that unsaturated trans fats in margarine were healthier** than saturated fats in butter
- In 1984 CSPI* campaigned against saturated fats in the fast food industry (replacement saturated fats -- trans fats)
- In 1987, CSPI defended trans fats in their newsletter
- In 1992, CSPI started speaking out *against* trans fats
- In 1994, it was estimated that trans fats caused over 30,000 deaths a year

* CSPI Center for Science in the Public Interest

The margerine production started

animal fats

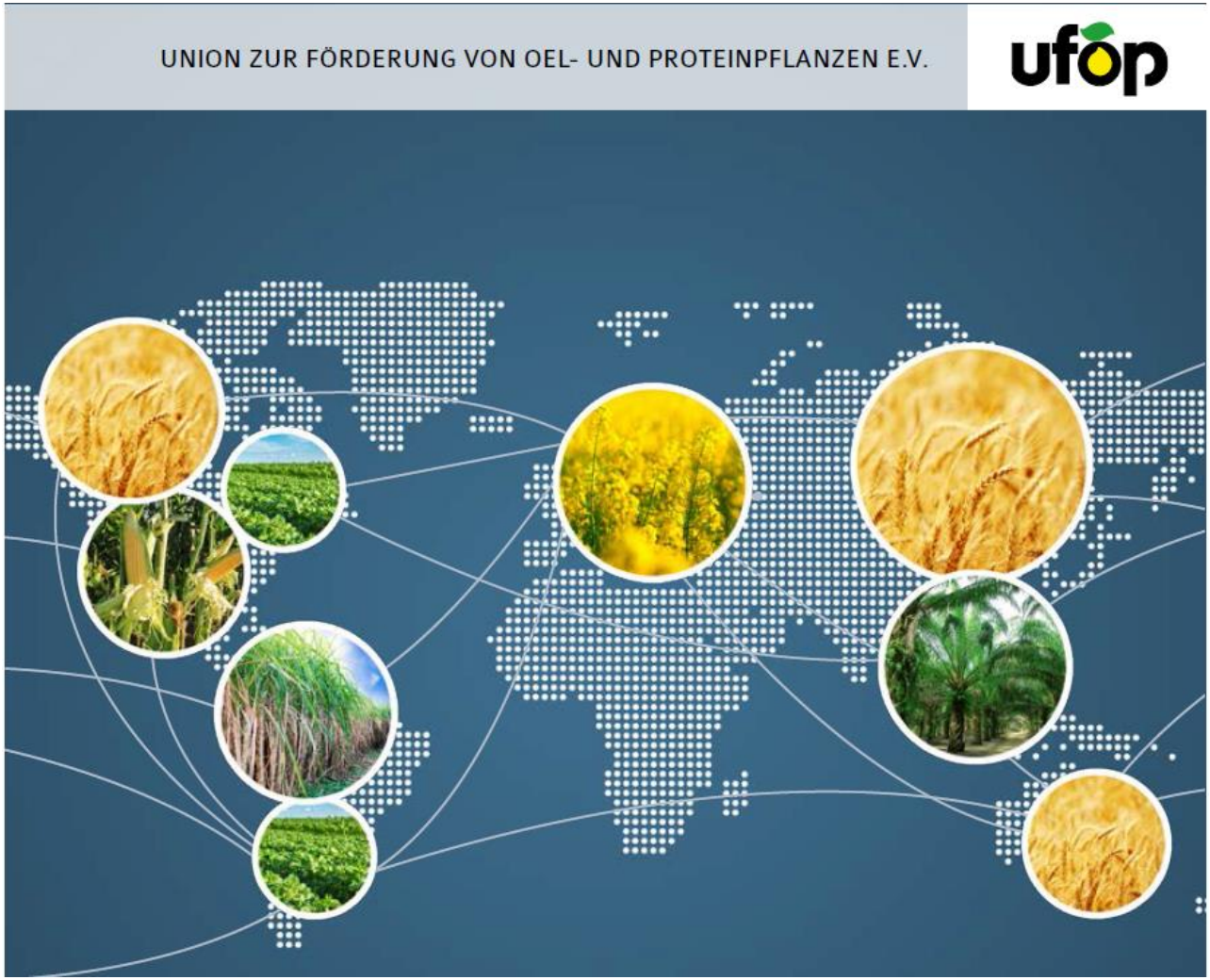
vegetable fats, principally

cottonseed, soybean, sunflower,

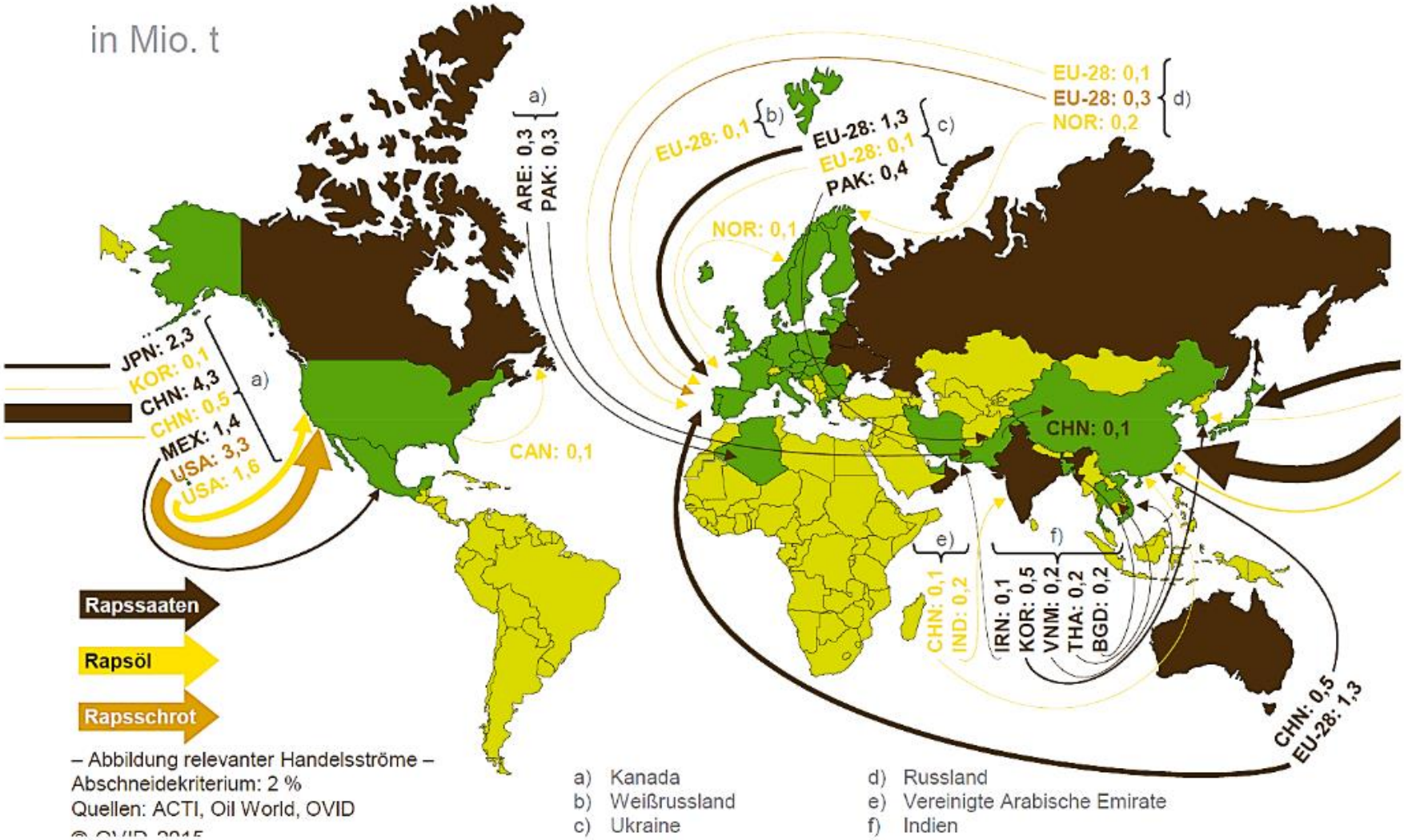
coconut, peanut, and corn oils

more recently: palm oil.

The world-wide fat market



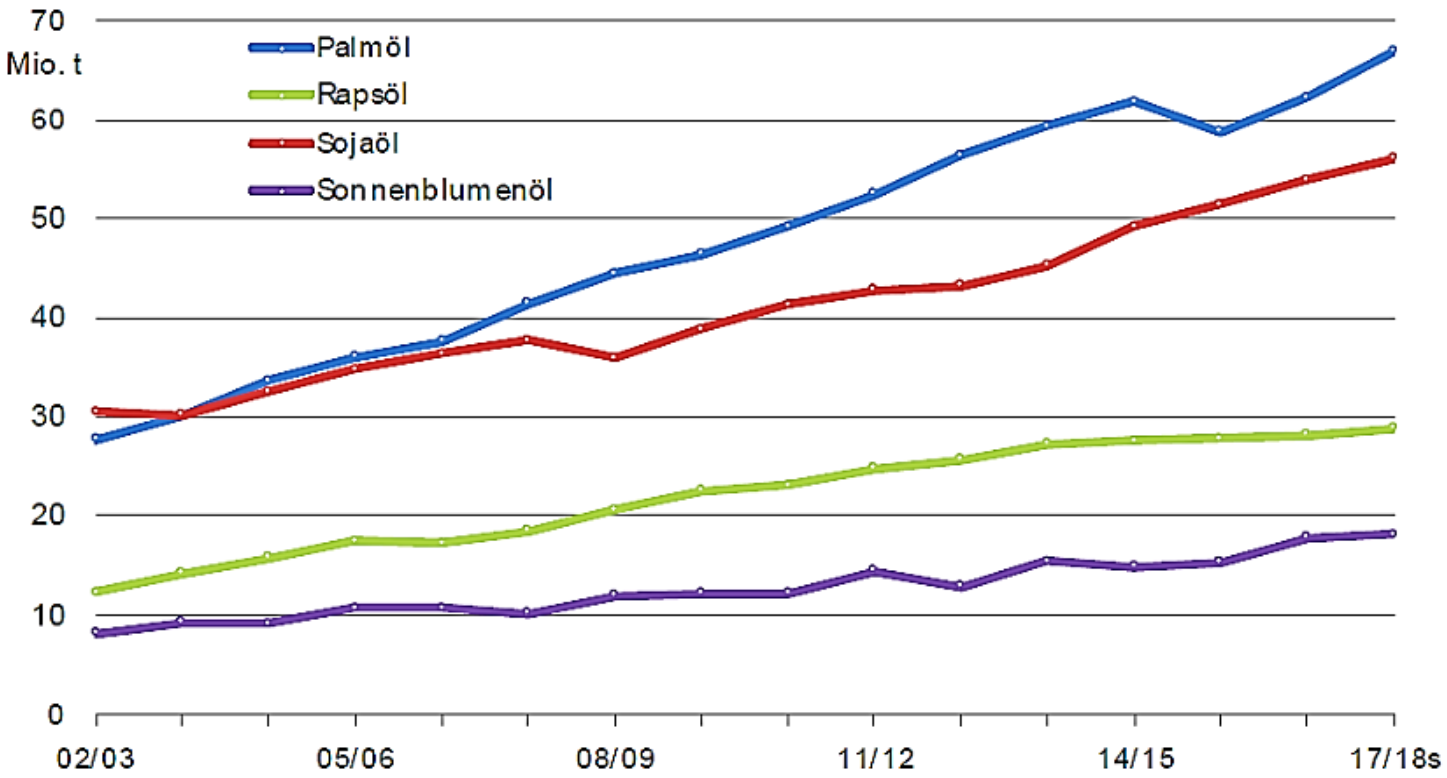
Trade rapeseed and rapeseed oil in 2014



OVID (2015), nach Oil World, ACTI, GTIS

Source: https://www.dbu.de/media/180118063306slms.pdf

Development of global production of vegetable oils (in million tons)



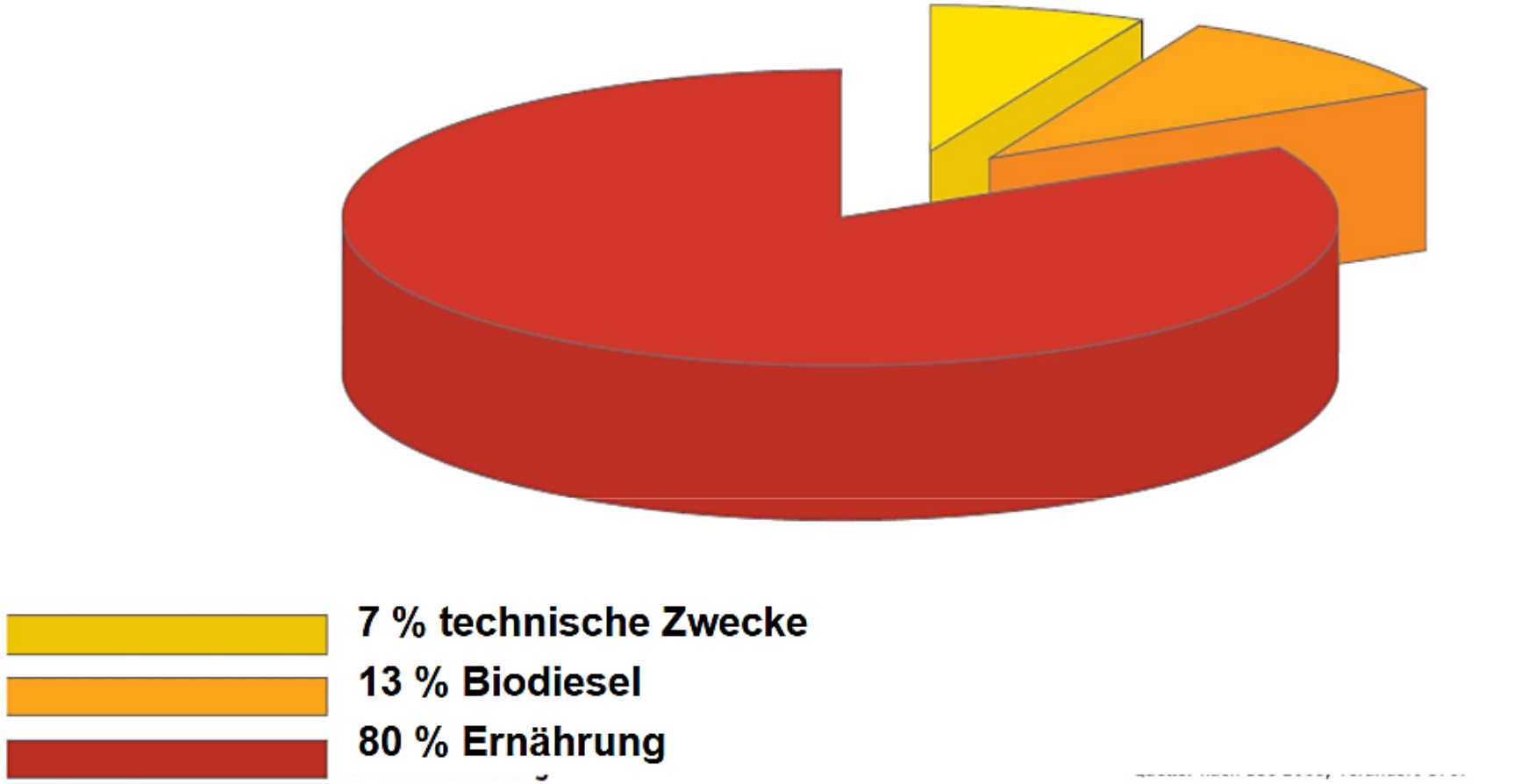
Stark steigende Nachfrage nach Pflanzenölen

In 20 Jahren von 70 Mio. t auf 195 Mio. t

UFOP 2018, nach USDA

Source: https://www.dbu.de/media/180118063306slms.pdf

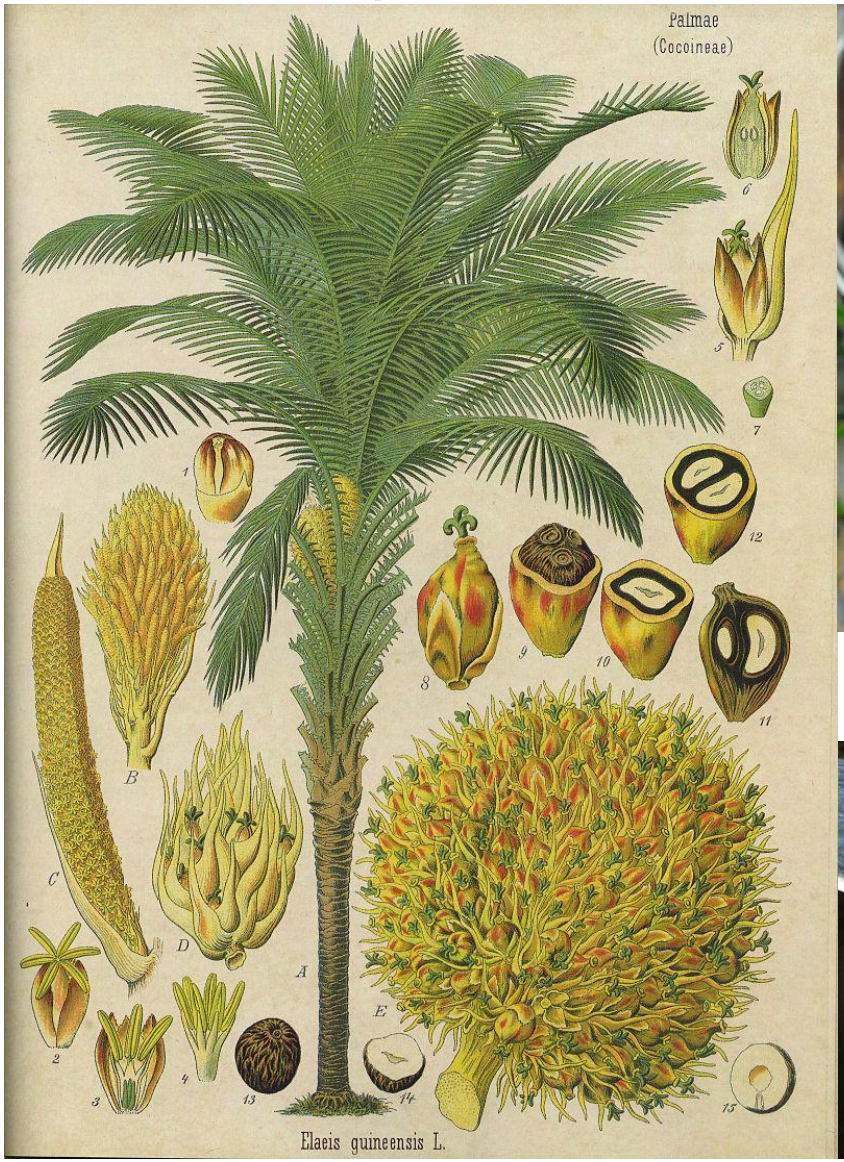
Worldwide use of vegetable oils in 2015



OECD-FAO AGRICULTURAL OUTLOOK 2015

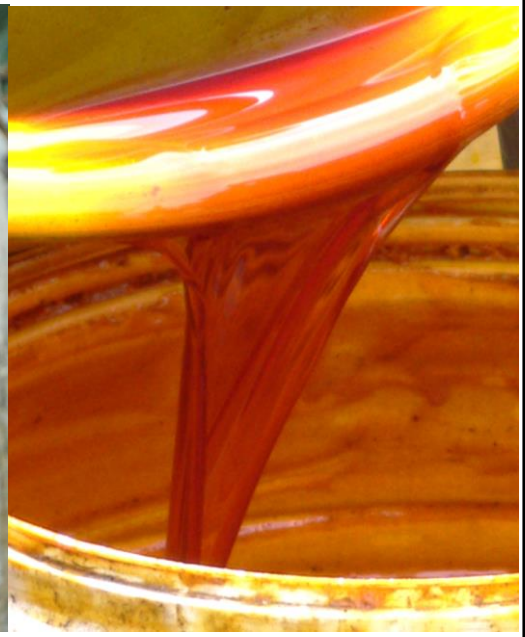
Source: https://www.dbu.de/media/180118063306slms.pdf

Oil palm



Source: https://de.wikipedia.org/wiki/Palm%C3%B6l

Fruits of the oil palm



Palm oil: reddish color

Orangutans directly threatened

Palm Oil production

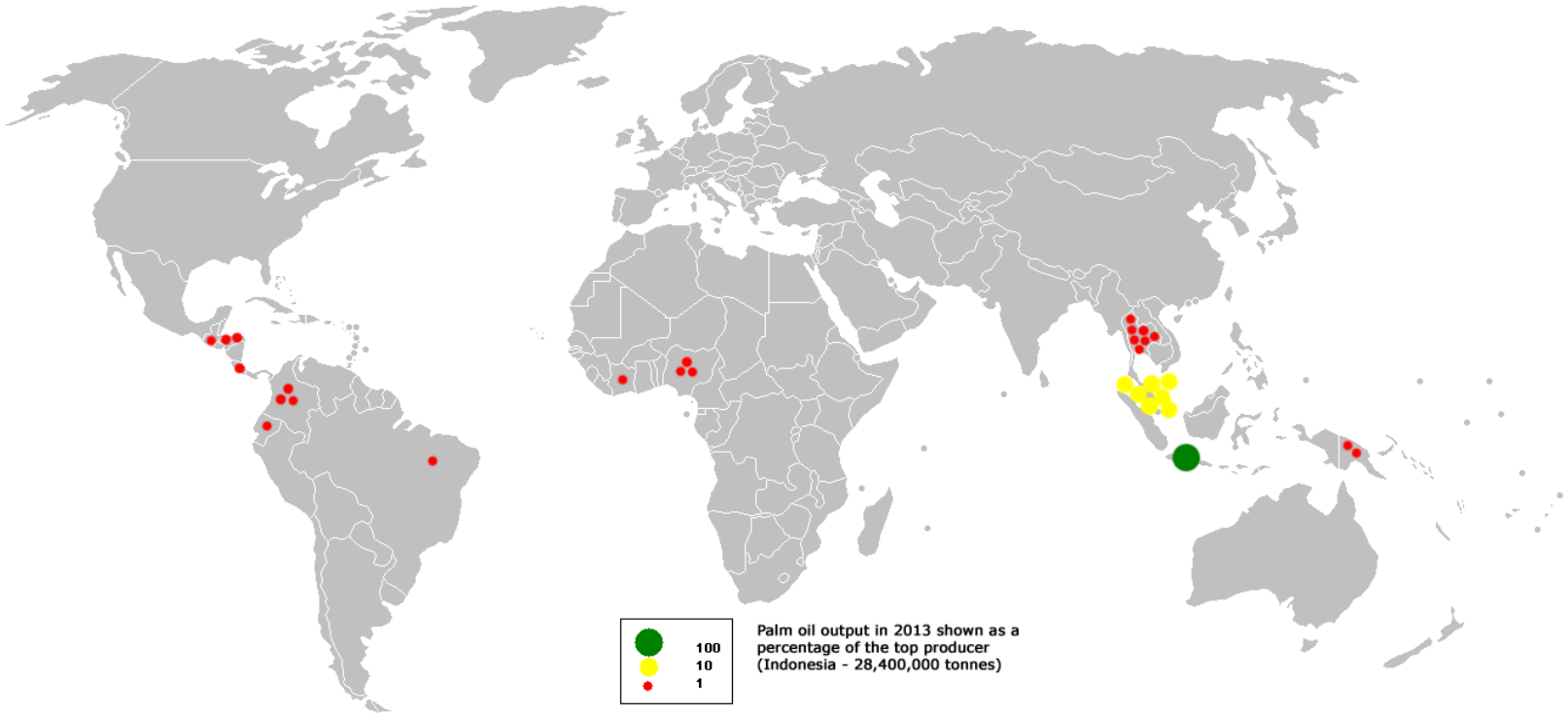
World: 17 millionen hektar (half of Germany)
Production: about 60 Millionen tons palmoil and palm kernel oil

Source: https://www.worldwildlife.org/industries/palm-oil

Impacts

Source: https://www.worldwildlife.org/industries/palm-oil

https://en.wikipedia.org/wiki/Palm_oilt



Palm oil output in 2013 shown as a percentage of the top Producer (Indonesia 28.400.00 tonnes)

Impacts of Palm Oil

- displaced **tropical forests** across Asia, Latin America, West Africa.

- Around 90% of the world's oil palm trees are grown on a **few islands in Malaysia and Indonesia**

- These islands have most biodiverse tropical forests found on Earth.

- In these places, there is a direct relationship between **the growth of oil palm estates and deforestation.**

- Palm oil is a small ingredient **in the U.S. diet**, but more than half of all packaged products Americans consume contain palm oil

- it’s found in lipstick, soaps, detergents and even ice cream.

https://www.worldwildlife.org/industries/palm-oil

Is Palm Oil good or bad?

Palm oil is the world's **most popular vegetable oil**, used in about half of the products on supermarket shelves.

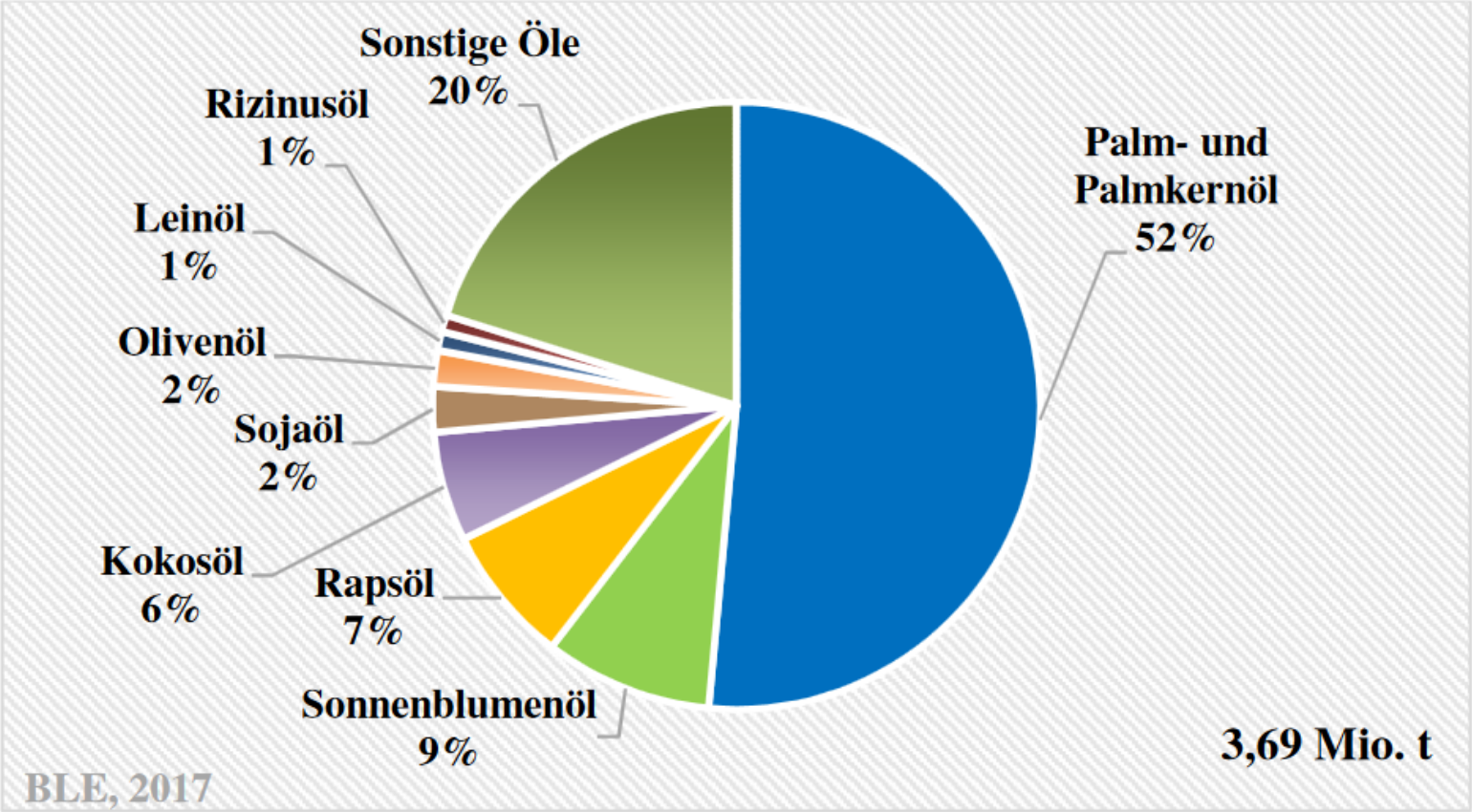
n tropical environments, it **grows easily and is more efficient than soy, canola, and other plants.**

The bad news: Its popularity has spurred the rapid and uncontrolled expansion of palm oil plantations across the forests of Indonesia and Malaysia and, increasingly, the jungles of Africa and Latin America.

The good news: The Roundtable on Sustainable Palm Oil certifies more than 20 percent of the global palm oil supply. Certification means the oil is produced in ways that conserve natural resources and protect the forests and rivers that wildlife call home.

https://www.worldwildlife.org/industries/palm-oil

Imports of plant oils, Germany 2015/2016

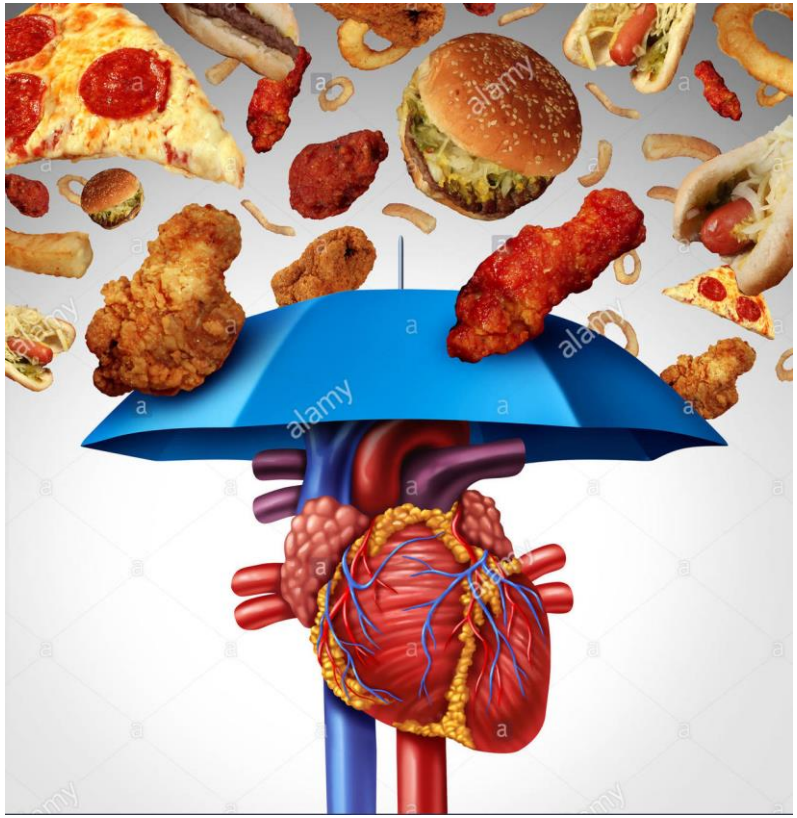


Quelle: Statistisches Bundesamt, 2017

Source: https://www.ble.de/SharedDocs/Downloads/DE/BZL/Daten-Berichte/OeleFette/Versorgung/2016BerichtOele.pdf?__blob=publicationFile&v=3

Ende of part 1 = brake time

Trans Fats and Health Risks



Summary

Part 2

- Trans Fats and Health Risks
- Trans Fat in the News
- What is Currently Being Done?

Saturated fats : unsaturated fats

- **Diets high in saturated fats can cause Coronary Heart Disease (CHD)**
  - Big push in the 80s and 90s to replace saturated fats with trans-unsaturated fats (replace butter with margarine etc.)
  - Some say “Big Business” played a role in demonizing saturated fats

- Controversy on whether **trans-unsaturated fats are better or worse** than saturated fats

Trans Fats and Health Risks (1)

- Not necessary or beneficial to health
- Hydrogenation causes essential fatty acids to be destroyed
- Causes more inflammation
  - Inflammation may play a role in fatty blockages in the heart blood vessels
- Increase triglycerides

Trans Fats and Health Risks (2)

- Cancer
  - No significant evidence that trans fat increases risk
  - Current studies are finding it *may* have a connection to prostate cancer

- Diabetes
  - Some evidence suggests that risk of type-2 diabetes increases with trans fat consumption
  - No conclusions have been made

Trans Fats and Health Risks (3)

- Obesity
  - No scientific evidence that specifically links trans fat intake to obesity
  - People who eat a lot tend to eat a lot of trans fat
    - Does not mean that trans fat is the specific cause of obesity
- Fertility
  - Research showed that increases in trans fat may cause increases in infertility in women
- **CHD is the only health risk with strong evidence linking it to trans fat intake**

Coronary Heart Disease (CHD)

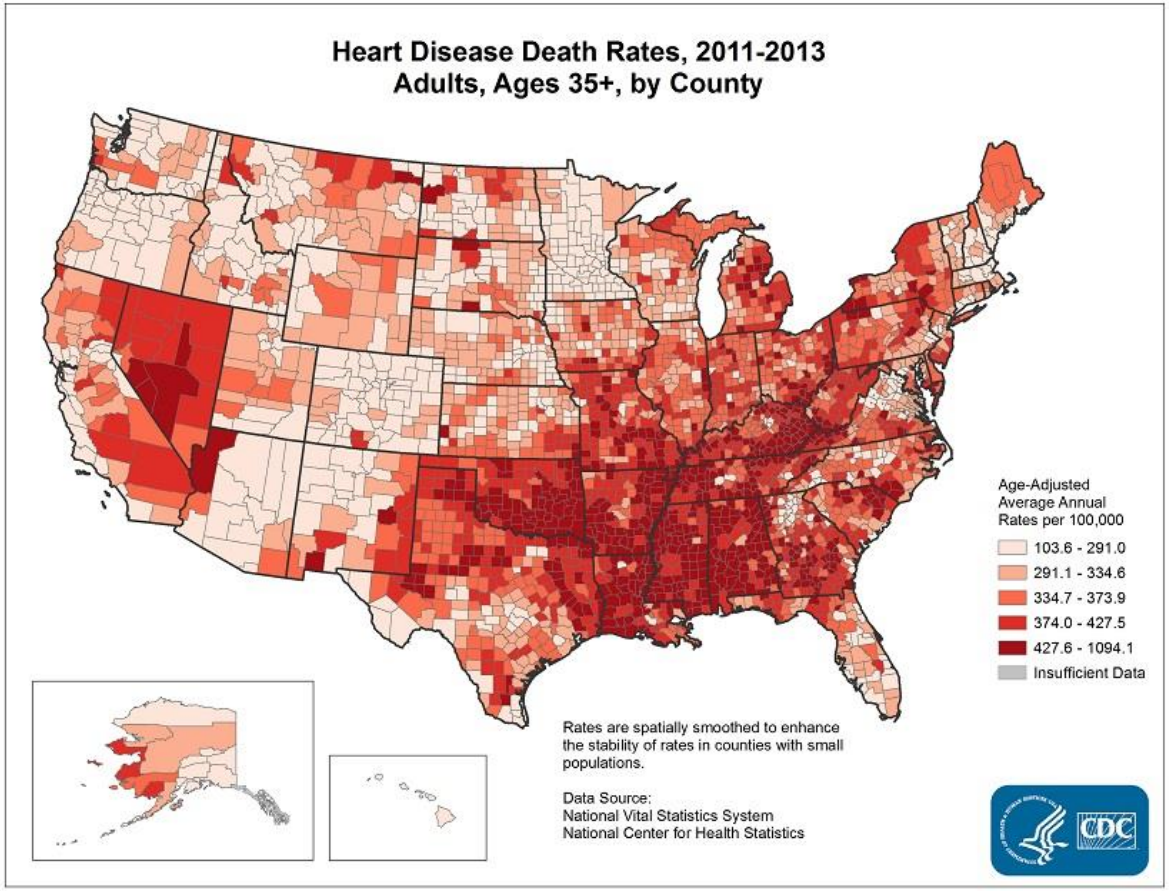
- Coronary Heart Disease
  - CHD risk doubles with each 2% increase in *trans fat* consumed
  - CHD risk doubles with each 15% increase in *sat fat* consumed

- Trans fat and sat fat increases levels of **LDL (bad cholesterol)** in the body

- Trans fat, but *not* sat fat, decreases levels of **HDL (good cholesterol)** in the body

- (As a result, the increase in the LDL/HDL ratio due to trans fat is about double that due to sat fat)

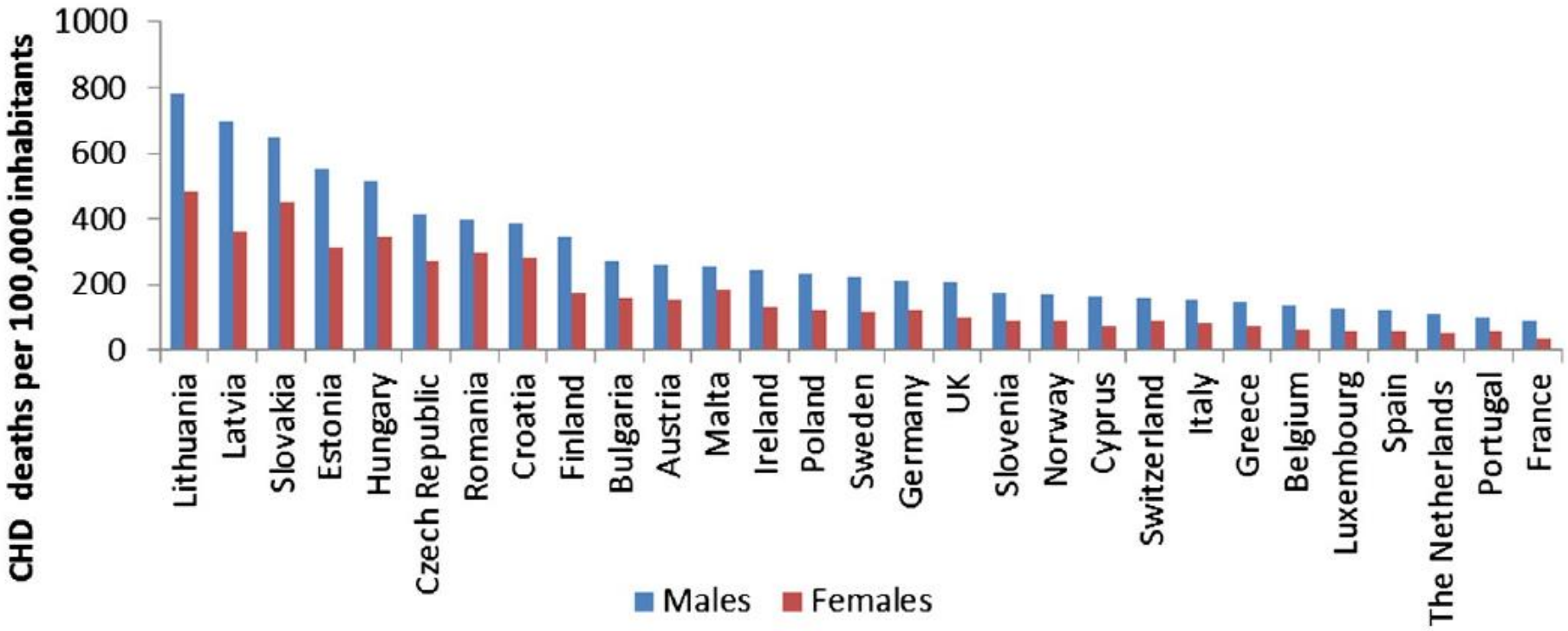
USA: Heart Disease Death Rates, 2011-13



https://www.google.com/search?q=cases+of+heart+attack+usa&client=firefox-b&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj-7rqZ9ereAhWHhSwKHa5QDbYQ_AUIDygC&biw=1680&bih=894#imgrc=5SA7gqivA3l0dM

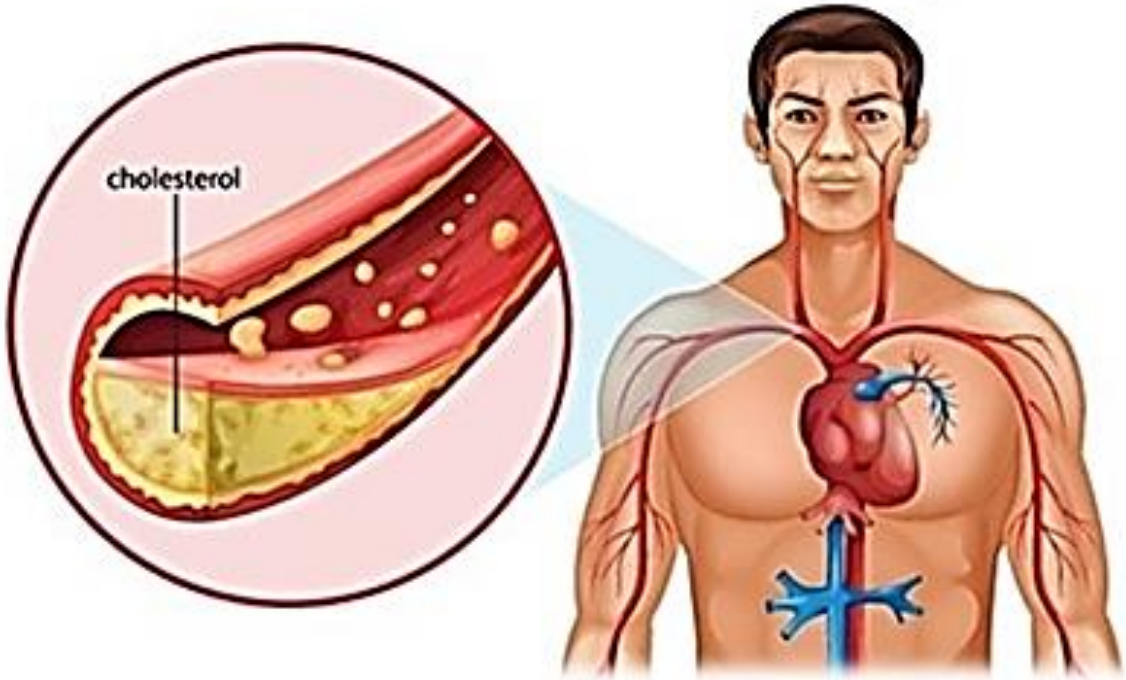
European Union: Heart Disease Death

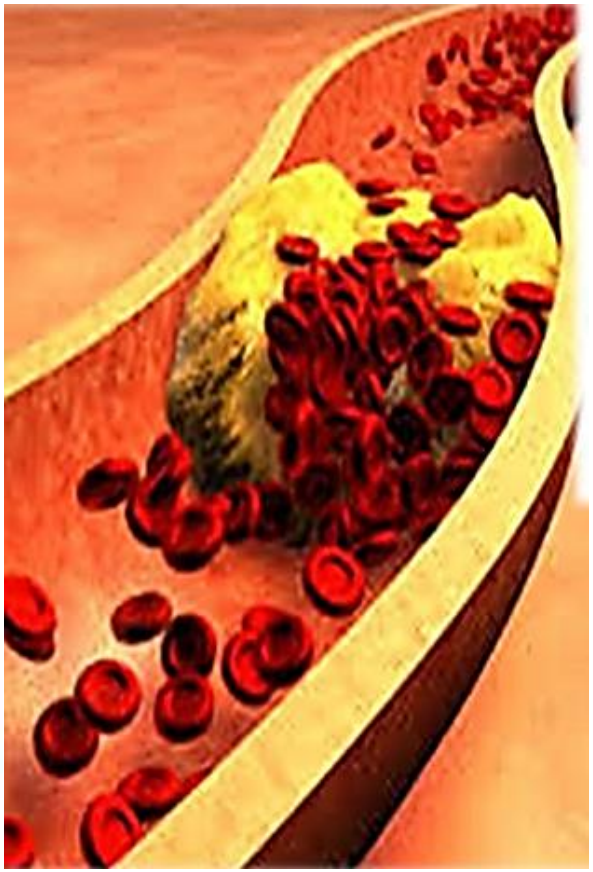
Standardized death rate per 100,000 inhabitants



Source: https://www.researchgate.net/publication/275722487

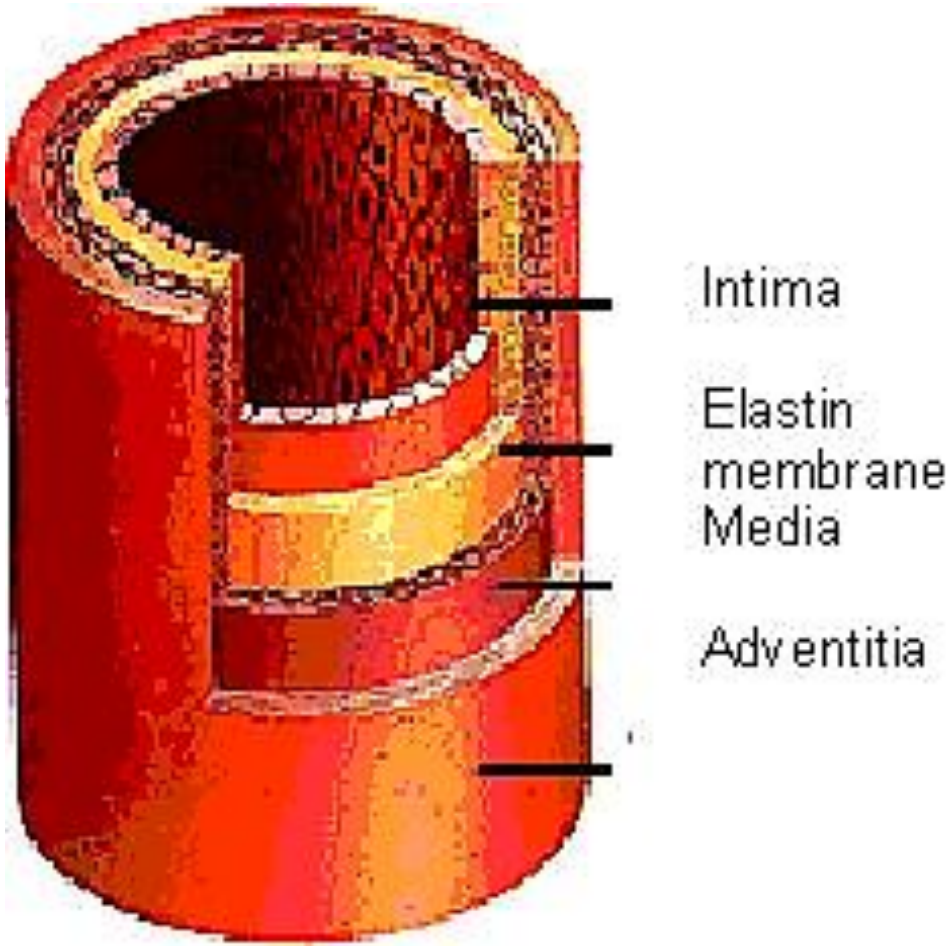
Hyperlipidemia



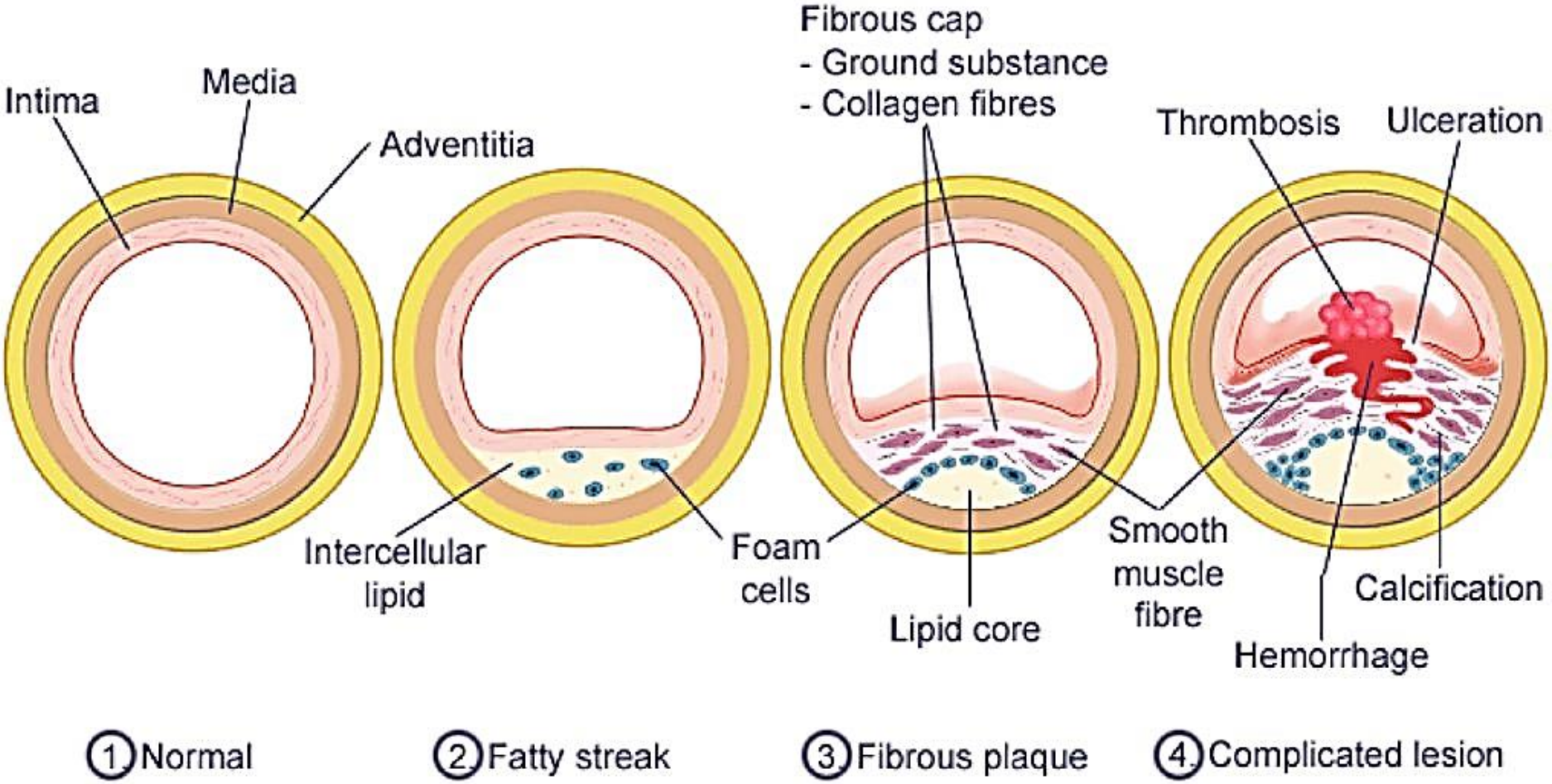


© Net photo

Blod vessel

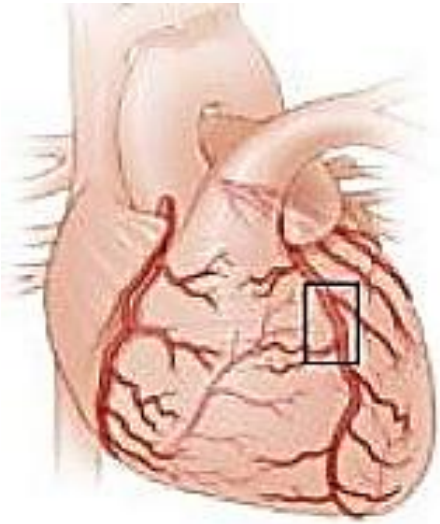


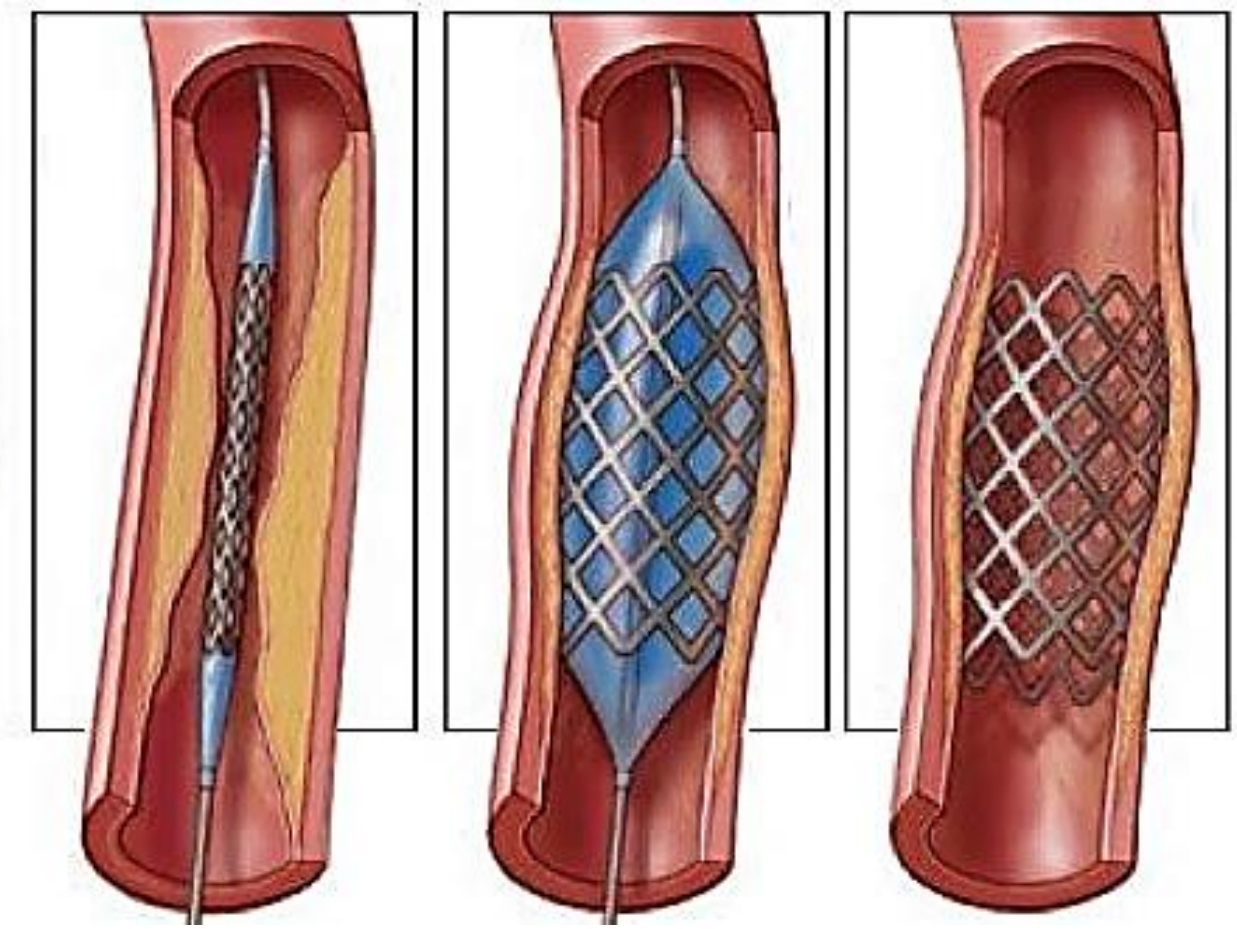
Progression of Atherosclerosis



Source: www.slideplayer.com

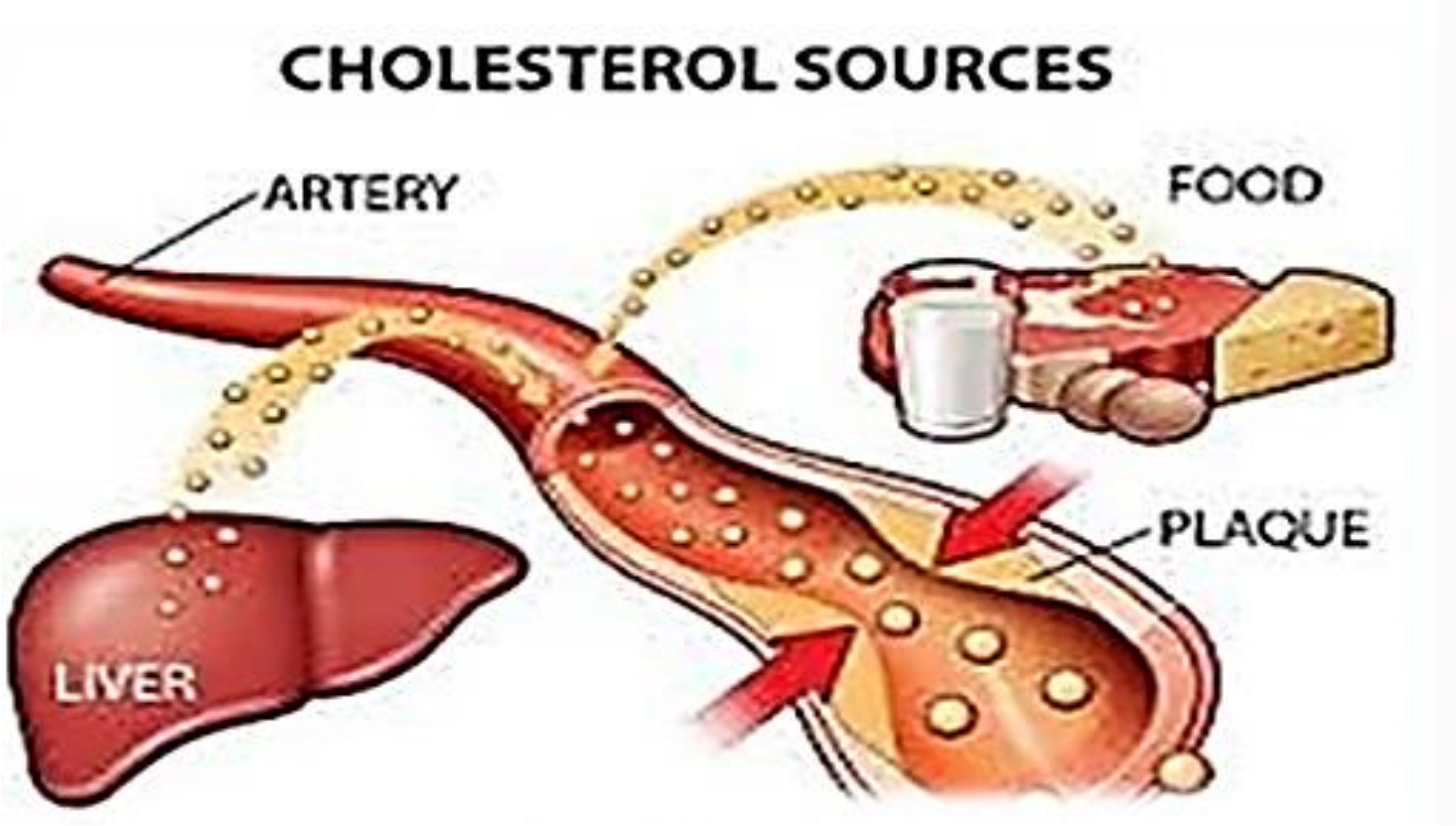
Progress of Atherosclerosis





‚Stent‘

Hyperlipidemia

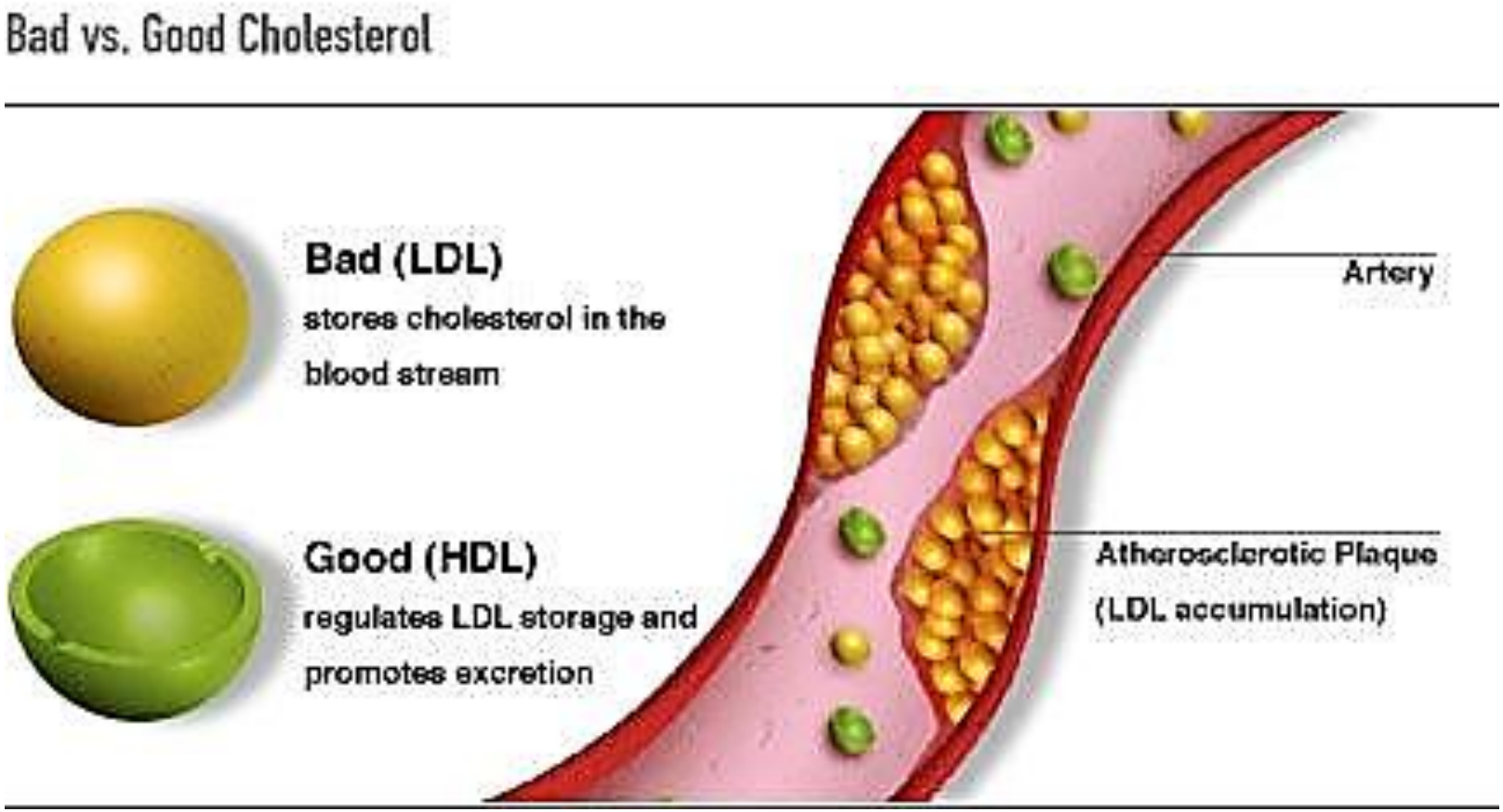


© source: Net photo

Cholesterol: good and bad!

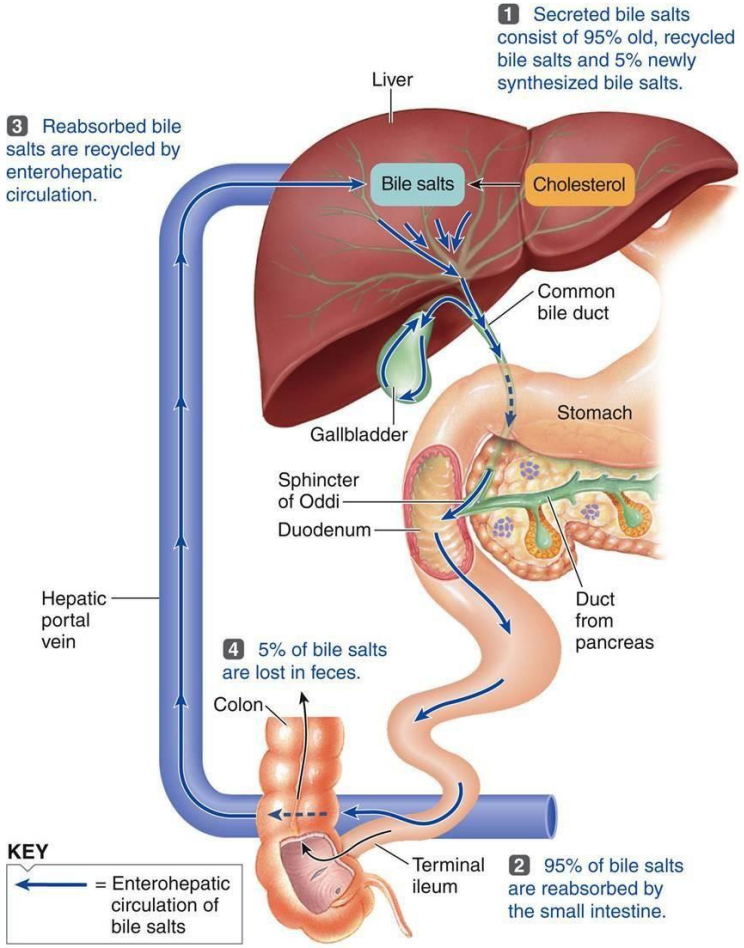
- LDL
  - Transports cholesterol throughout the body
  - When too much is present, builds up in the walls of arteries
    - Makes arteries hard and narrow
- HDL
  - Picks up extra cholesterol and brings it back to the liver

Trans Fats and Health Risks



Enterohepatic billary cycle

:



https://www.google.com/search?q=enterohepatic+cycle&client=firefox-b&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj22b7T8-fcAhVBISwKHVZcAIsQ_AUIDigB&biw=1680&bih=894#imgrc=frRl7Y0TYsb1jM

Video „American Heart Association“

https://www.heart.org/en/health-topics/cholesterol/hdl-good-ldl-bad-cholesterol-and-triglycerides

Recommendations of intake (1)

Germany DGE 2016! (D-A-CH)

Fat: 30-35 % of the total energy intake for adults
from that 7-10 % saturated
7-10 % polyunsaturated
< 1% trans fatty acids

(2.300 Kcal (male, 25-51 years): **2,6 g trans fats**

So far: NO DUTY OF DECLARATION in Europe

Recommendations of intake (2)

EFSA 2010! (European Food Safety Authority)

20-35 % of the total energy intake for adults
Restriction of intake of trans fatty and saturated acids in favor of mono- and polyunsaturated fatty acids

(Source: https://www.efsa.europa.eu/de/press/news/100326)

Recommendations of intake (3)

WHO (May 2018)

- plans to eliminate industrially-produced trans-fatty acids from global food supply
- recommends that the total trans fat intake be limited to less than 1% of total energy intake (less than 2.2 g/day with a 2,000-calorie diet).

(Source: http://www.who.int/news-room)

Trans Fats and Health Risks

- It has been found that trans fat found in breast milk varies with maternal trans fat intake
  - 1% in Spain
  - 2% in France
  - 7% in Canada

Trans Fats and Health Risks

Source: https://twitter.com/drfrieden/status/995993397579182080:

Pizza with salami

Nährwert	pro 100 g	Tagesbedarf: 2000 kcal
Eiweiß:	10,3 g	20,6%
Kohl.hyd.:	26,3 g	9,7%
davon Zucker:	2,2 g	2,4%
Fett:	14,0 g	20,0%
davon gesättigt:	**4,8 g**	24,0%
Ballaststoffe:	1,9 g	7,6%
Natrium:	0,61 g	25,4%
Energie:	277,0 kcal / 1159,7 kJ	

Chips (Germany) – Zutaten/Nährwerte

Fettgehalt 35 g

Gesättigte Fettsäuren 11 g

Mehrfach ungesättigte Fettsäuren 12 g

Einfach ungesättigte Fettsäuren 10 g

Cholesterin 0 mg

Natrium 8 mg

Kalium 1.275 mg

Kohlenhydrate 53 g

Ballaststoff 4,8 g

Zucker 0,2 g

Protein 7 g

Potato chips

Nutrition Facts

1 serving per container

Serving size	**1 package**
Amount per serving	
Calories	**240**
	% Daily Value*
Total Fat 15g	**19%**
Saturated Fat 2g	**11%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 250mg	**11%**
Total Carbohydrate 23g	**8%**
Dietary Fiber 2g	**7%**
Total Sugars 1g	
Protein 3g	
Vitamin D 0mcg	0%
Calcium 10mg	0%
Iron 0.8mg	4%
Potassium 530mg	10%
Vitamin C	10%

Not a significant source of added sugars.

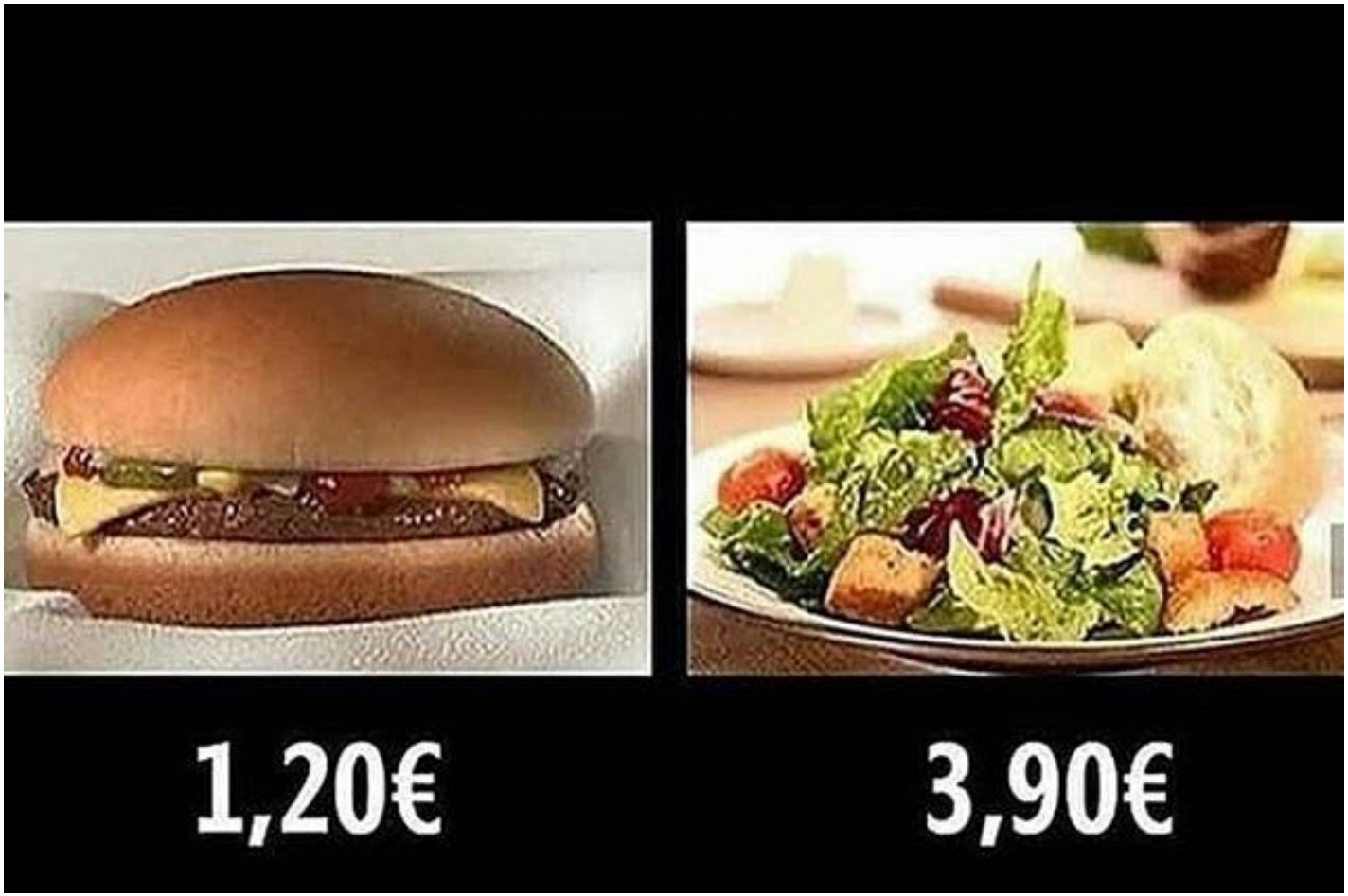
* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

No trans fatty acids in reform margarine

- natürliche OMEGA-3-Quelle
- reich an ungesättigten Fettsäuren
- rein pflanzlich, vegan
- aus ungehärteten Ölen und Fetten
- mit natürlichem Vitamin E
- mit Vitamin D
- frei von Laktose und Gluten
- ohne Salzzusatz
- ohne Konservierungsstoffe

52 % Rapsöl, pflanzliches Fett (Palm), Trinkwasser, Emulgatoren (Sonnenblumenlecithine, Mono- und Diglyceride von Speisefettsäuren), Aroma, Säuerungsmittel (Citronensäure, Calciumcitrat), Vitamin D, Farbstoff Carotin.

Reasons why people get fat



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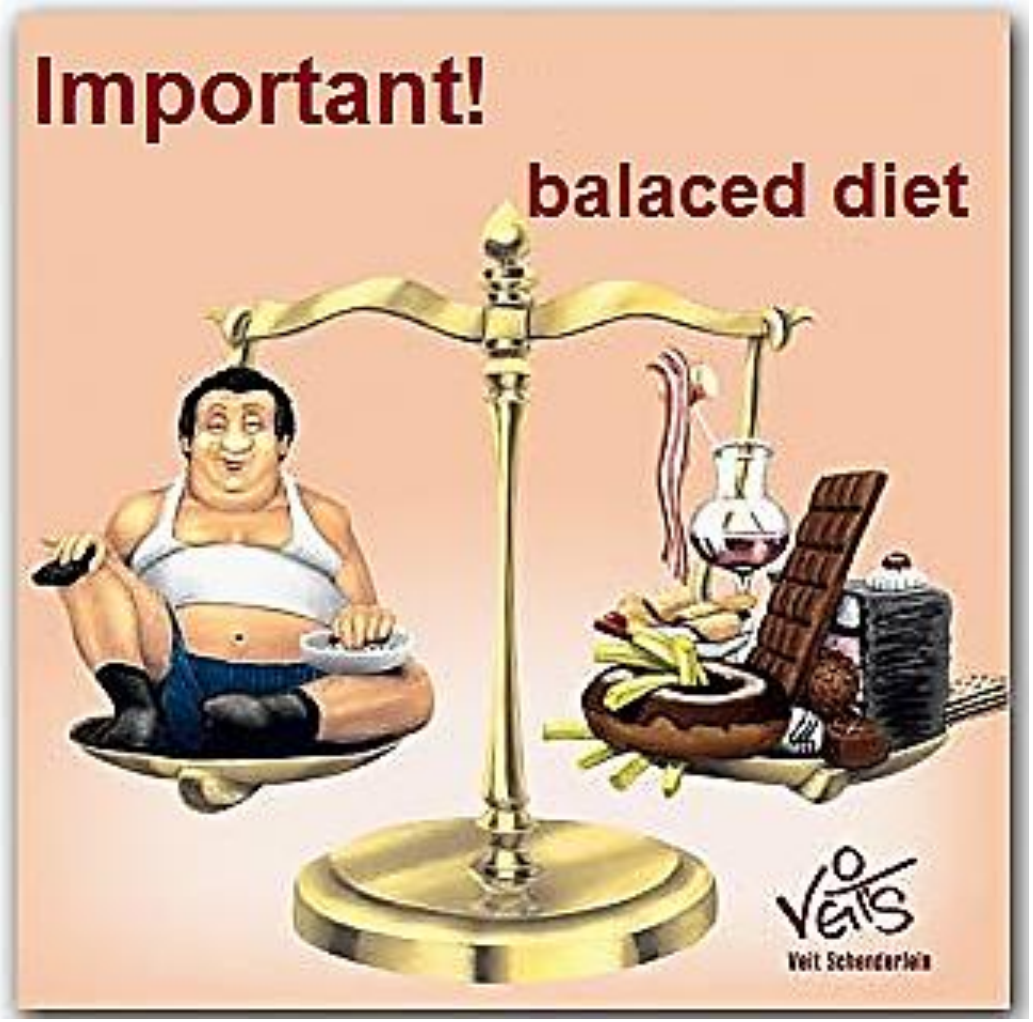
Thank you for your attention!



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lustige Servietten

References

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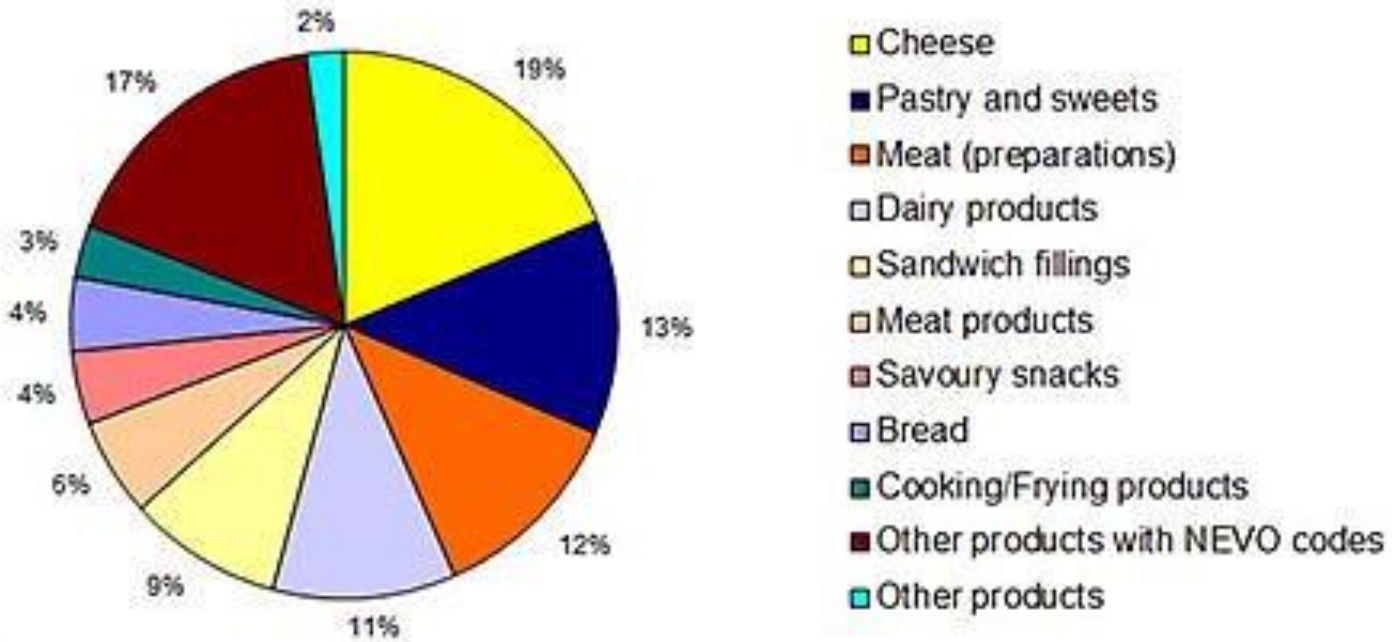
Major food groups for intake of saturated fat, Netherlands, 2007-10

Contribution to the consumption of saturated fatty acids per product group (%) *



*including naturally present

Source: https://www.rivm.nl/en/food-reformulation/food-product-compositon

https://www.google.com/search?q=trans+fat+acids+is+food&client=firefox-b&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiSp9DR7ureAhULGCwKHaDAAQoQ_AUIDygC&biw=1680&bih=894#imgrc=DUThbA87HEX-VM:

Das ist doch der Hammer oder ? In Ungarn sind die nuggets noch fetter!!