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# Primary prevention of atherosclerotic cardiovascular diseases

Lifestyle-oriented recommendations and advice

Jindřich Fiala
Department of Public Health

# Basic documents (guidelines) for prevention of ASCVD

ASCVD = AtheroSclerotic CardioVascular Disease

- **2016 European guidelines on CD prevention in clinical practice**
  - European Heart Journal (2016) 37, 2315–2381
    www.athero.cz/media/1542/2016-esc-eas-eacpr.pdf

- **2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease**
  - Circulation. 2019;140:e596–e646

ACC = American College of Cardiology
AHA = American Heart Association

# Cardiovascular Diseases Prevention – Definition and Rationale

## Definition of CVD prevention:

Cardiovascular disease (CVD) prevention is defined as a coordinated set of actions, at the population level or targeted at an individual, that are aimed at eliminating or minimizing the impact of CVDs and their related disabilities

## Current state and trends:

- CVD remains a leading cause of morbidity and mortality, despite improvements in outcomes.
- Age-adjusted coronary artery disease (CAD) mortality has declined since the 1980s, particularly in high-income regions. CAD rates are now less than half what they were in the early 1980s in many countries in Europe, due to preventive measures including the success of smoking legislation.
- However, inequalities between countries persist and many risk factors, particularly obesity and diabetes mellitus (DM), have been increasing substantially. If prevention was practised as instructed it would markedly reduce the prevalence of CVD. It is thus not only prevailing risk factors that are of concern, but poor implementation of preventive measures as well.

## Prevention should be delivered:

(i) at the general population level by promoting healthy lifestyle behaviour and

(ii) at the individual level, i.e. in those subjects at moderate to high risk of CVD or patients with established CVD, by tackling unhealthy lifestyles (e.g. poor-quality diet, physical inactivity, smoking) and by optimising risk factors.

## Efficiency:

Prevention is effective: the elimination of health risk behaviours would make it possible to prevent **at least 80% of CVDs** and even 40% of cancers.


Department of Public Health
Author: Jindřich Fiala

# 2016 European guidelines on CD prevention in clinical practice

European Heart Journal - Eur Heart J. 2016 Aug 1; 37(29): 2315–2381

This document has been developed to support **healthcare professionals communicating with individuals about their cardiovascular (CV) risk and the benefits of a healthy lifestyle** and **early modification of their CV risk**.

In addition, the guidelines provide tools for healthcare professionals to promote population-based strategies and integrate these into national or regional prevention frameworks and to translate these in locally delivered healthcare services, in line with the recommendations of the World Health Organization (WHO) global status report on non-communicable diseases 2010.

## „Class" = Classes of recommendations

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## „Level" = Level of evidence:

| | |
|---|---|
| Level of evidence A | Data derived from multiple randomized clinical trials or meta-analyses. |
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# SCORE – Systematic Coronary Risk Estimation

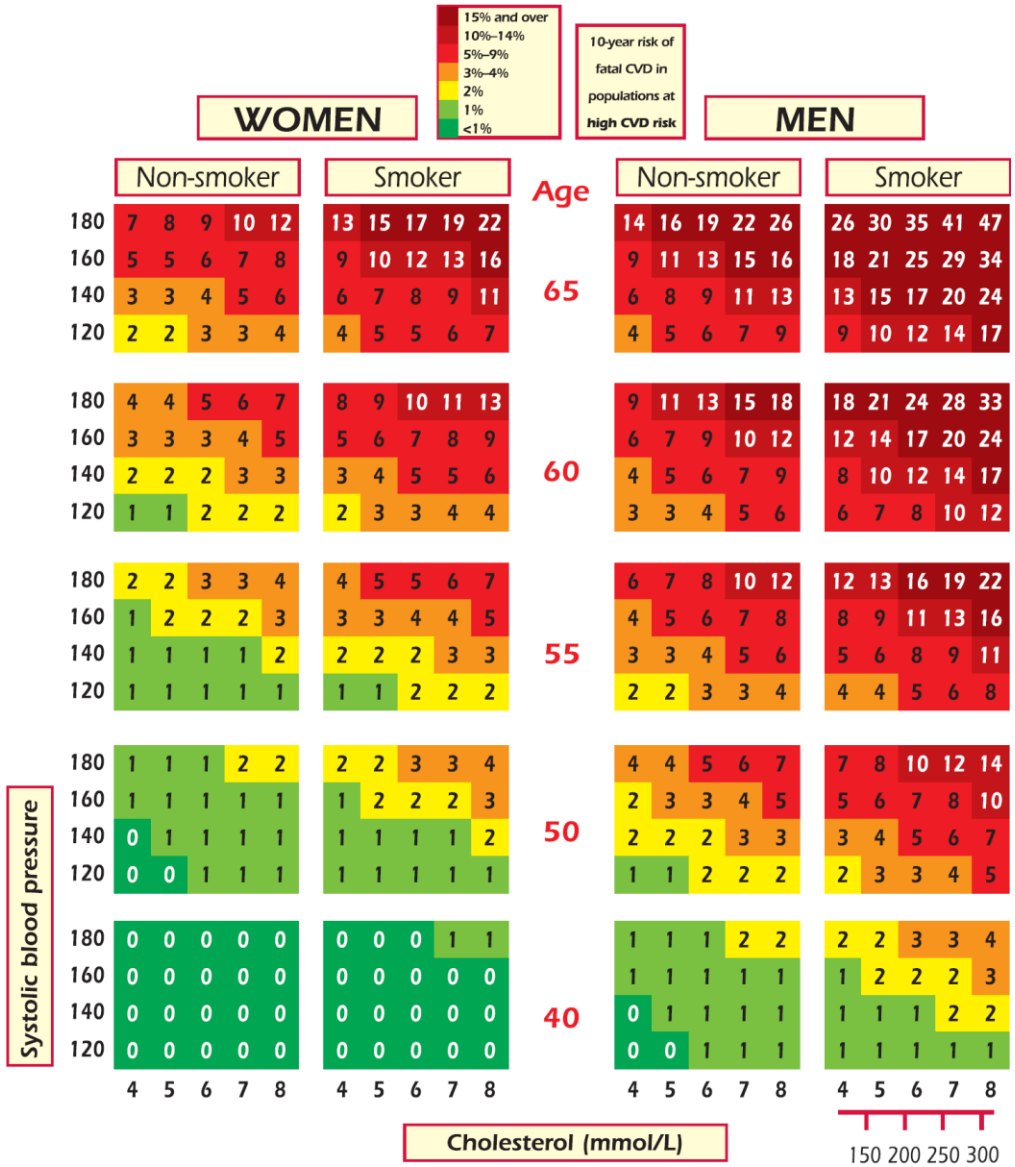
***SCORE chart:***

10-year risk of fatal cardiovascular disease in populations of **countries at high cardiovascular risk** based on the following risk factors:

- Age,
- Sex,
- Smoking,
- Systolic blood pressure,
- Total cholesterol.

***High risk countries:***
Bosnia and Herzegovina, Croatia, **Czech Republic**, Estonia, Hungary, Lithuania, Montenegro, Morocco, Poland, Romania, Serbia, Slovakia, Tunisia and Turkey

***Low risk:***
Andorra, Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, The Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.




**Low- to moderate-risk persons (calculated SCORE <5%):**
should be offered lifestyle advice to maintain their low- to moderate-risk status.

**High-risk persons (calculated SCORE ≥5% and <10%):**
qualify for intensive lifestyle advice and may be candidates for drug treatment.

**Very-high-risk persons (calculated SCORE ≥10%):**
drug treatment is more frequently required.

***Advantages***

- Intuitive, easy to use tool.
- Establishes a common language of risk for healthcare professionals.
- Allows a more objective assessment of risk.
- Takes account of the multifactorial nature of CVD.
- Allows flexibility in management; if an ideal risk factor level cannot be achieved, total risk can still be reduced by reducing other risk factors.
- Deals with the problem of a low absolute risk in young people with multiple risk factors: the relative risk chart helps to illustrate how a young person with a low absolute risk may be at a substantially high and reducible relative risk; calculation of an individual's "risk age" may also be of use in this situation.

***Limitations***

- Estimates risk of fatal but not total (fatal + non-fatal) CV risk for
- reasons outlined in text.
- Adapted to suit different European populations, but not different
- ethnic groups within these populations.
- Limited to the major determinants of risk.
- Other systems have more functionality, although applicability to
- multiple countries is uncertain.
- Limited age range (40–65 years).


Department of Public Health
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# Lifestyle factors affecting cardiovascular risk and other risk factors for behavioral intervention

- **Sedentary behavior and physical activity**
  - Prescription of PA, aerobic PA, Strengthening -resistance exercises, neuromotor PA
- **Smoking interventions**
  - Doses and types, Passive smoking, mechanisms, smoking cessation, electronic cigarettes
- **Nutrition**
  - Fatty acids
  - Minerals
  - Vitamins
  - Fibre
  - Foods and food groups (Vegetables and Fruits, Nuts, Fish, Soft drinks and sugar)
  - Dietary patterns
  - Functional foods
- **Alcohol**
  - The question of the relationship between alcohol consumption (dose) and cardiovascular risk
- **Body weight**
  - Which index of obesity is the best predictor od cardiovascular risk, goals, does metabolically healthy obesity exist?
- Lifestyle intervention for **Lipid control**
- Lifestyle intervention for **Glucose control and type 2 DM**
- Lifestyle intervention for **Blood Pressure lowering**


Department of Public Health
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# Recommendations for assessment of family history/(epi)genetics

Familial history of premature CVD is a crude but simple indicator of the risk of developing CVD, reflecting both the **genetic trait** and the **environment shared among household members**. A positive family history of premature CV death is associated with an increased risk of early and lifetime CVD.

A family history of premature CVD is simple, inexpensive information that should **be part of the CV risk assessment in all subjects**. Family history can be a **risk modifier** to optimal management after the calculated risk using SCORE lies near a decisional threshold: a positive family history would favour more intensive interventions, while a negative family history would translate into less intensive treatment

**2016 European guidelines on CD prevention in clinical practice:**

| Recommendations | Class[a] | Level[b] |
|---|---|---|
| Assessment of family history of premature CVD (defined as a fatal or non-fatal CVD event or/and established diagnosis of CVD in first degree male relatives before 55 years or female relatives before 65 years) is recommended as part of cardiovascular risk assessment. | I | C |
| The generalized use of DNA-based tests for CVD risk assessment is not recommended. | III | B |

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European Heart Journal - Eur Heart J. 2016 Aug 1; 37(29): 2315–2381

# Psychosocial factors



***Key messages:***

- Low socio-economic status, lack of social support, stress at work and in family life, hostility, depression, anxiety and other mental disorders contribute to the risk of developing CVD and a worse prognosis of CVD, with the absence of these items being associated with a lower risk of developing CVD and a better prognosis of CVD.
- Psychosocial risk factors act as barriers to treatment adherence and efforts to improve lifestyle, as well as to promoting health in patients and populations.

## Recommendation for assessment of psychosocial risk factors:

| Recommendation | Class[a] | Level[b] |
|---|---|---|
| Psychosocial risk factor assessment, using clinical interview or standardized questionnaires, should be considered to identify possible barriers to lifestyle change or adherence to medication in individuals at high CVD risk or with established CVD. | IIa | B |

Mechanisms that link psychosocial factors to increased CV risk include unhealthy lifestyle [more frequent smoking, unhealthy food choices and less physical activity (PA)] and low adherence to behaviour change recommendations or CV medication. In addition, depression and/or chronic stress are associated with alterations in autonomic function, in the hypothalamic–pituitary axis and in other endocrine markers, which affect haemostatic and inflammatory processes, endothelial function and myocardial perfusion. Enhanced risk in patients with depression may also be due in part to adverse effects of tricyclic antidepressants

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# Psychosocial factors

**Core questions for the assessment of psychosocial risk factors in clinical practice:**

| | |
|---|---|
| **Low socio-economic status** | • What is your highest educational degree?<br>• Are you a manual worker? |
| **Work and family stress** | • Do you lack control over how to meet the demands at work?<br>• Is your reward inappropriate for your effort?<br>• Do you have serious problems with your spouse? |
| **Social isolation** | • Are you living alone?<br>• Do you lack a close confidant?<br>• Have you lost an important relative or friend over the last year? |
| **Depression** | • Do you feel down, depressed and hopeless?<br>• Have you lost interest and pleasure in life? |
| **Anxiety** | • Do you suddenly feel fear or panic?<br>• Are you frequently unable to stop or control worrying? |
| **Hostility** | • Do you frequently feel angry over little things?<br>• Do you often feel annoyed about other people's habits? |
| **Type D personality** | • In general, do you often feel anxious, irritable, or depressed?<br>• Do you avoid sharing your thoughts and feelings with other people? |
| **Post-traumatic stress disorder** | • Have you been exposed to a traumatic event?<br>• Do you suffer from nightmares or intrusive thoughts? |
| **Other mental disorders** | • Do you suffer from any other mental disorder? |

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# Physical activity

**Key messages:**

- Regular PA is a mainstay of CV prevention; participation decreases all-cause and CV mortality.
- PA increases fitness and improves mental health.
- Sedentary subjects should be encouraged to start light-intensity aerobic PA.

- Prescription of PA, aerobic PA, Strengthening -resistance exercises, neuromotor PA

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**Recommendations for physical activity:**

| Recommendation | Class | Level |
|---|---|---|
| It is recommended for healthy adults of all ages to perform at least **150 min a week** of **moderate** intensity or **75 min a week** of **vigorous** intensity aerobic PA or an equivalent combination thereof. | I | A |
| For **additional benefits** in healthy adults, a gradual increase in aerobic PA to **300 min a week** of **moderate** intensity, or **150 min a week** of **vigorous** intensity aerobic PA, or an equivalent combination thereof is recommended. | I | A |
| Regular **assessment** and **counselling** on PA is recommended to **promote the engagement** and, if necessary, to support an increase in PA volume over time. | I | B |
| PA is recommended in **low-risk** individuals **without further assessment**. | I | C |
| **Multiple sessions** of PA should be considered, each lasting **≥10 min** and **evenly spread** throughout the week, i.e. on 4–5 days a week and preferably **every day** of the week. | IIa | B |
| Clinical evaluation, including exercise testing, should be considered for sedentary people with CV risk factors who intend to engage in vigorous PAs or sports. | IIa | C |

- MET (metabolic equivalent) is estimated as the energy cost of a given activity divided by resting energy expenditure: 1 MET = 3.5 mL O2 kg-1 min-1 oxygen consumption (VO2).
- RPE, rating of perceived exertion (20 value Borg score).
- %HRmax, percentage of measured or estimated maximum heart rate (220-age).

**Classification of physical activity intensity and examples of absolute and relative intensity levels:**

| Absolute intensity | | | Relative intensity | | |
|---|---|---|---|---|---|
| **Intensity** | **MET** | **Examples** | **%HRmax** | **RPE (Borg scale score)** | **Talk Test** |
| Light | 1.1–2.9 | Walking <4.7 km/h, light household work. | 50–63 | 10–11 | |
| Moderate | 3–5.9 | Walking briskly (4.8–6.5 km/h), slow cycling (15 km/h), painting/decorating, vacuuming, gardening (mowing lawn), golf (pulling clubs in trolley), tennis (doubles), ballroom dancing, water aerobics. | 64–76 | 12–13 | Breathing is faster but compatible with speaking full sentences. |
| Vigorous | ≥6 | Race-walking, jogging or running, bicycling >15 km/h, heavy gardening (continuous digging or hoeing), swimming laps, tennis (single). | 77–93 | 14–16 | Breathing very hard, incompatible with carrying on a conversation comfortably. |

# Smoking intervention

**Key messages:**

- Stopping smoking is the most cost-effective strategy for CVD prevention.
- There is a strong evidence base for brief interventions with advice to stop smoking, all types of nicotine replacement therapy (NRT), bupropion, varenicline and greater effectiveness of drugs in combination, except for NRT plus varenicline. The most effective are brief interventions plus assistance with stopping using drug therapy and follow-up support.
- Electronic cigarettes (e-cigarettes) may help in smoking cessation but should be covered by the same marketing restrictions as cigarettes.
- Passive secondary smoking carries significant risk, with the need to protect non-smokers

## Recommendations for smoking intervention strategies:

| Recommendation | Class | Level |
|---|---|---|
| It is recommended to **identify smokers** and provide repeated **advice on stopping** with **offers to help**, by the use of follow up support, nicotine replacement therapies, varenicline, and bupropion individually or in combination. | I | A |
| It is recommended to **stop all smoking** of tobacco or herbal products, as this is **strongly and independently causal of CVD**. | I | B |
| It is recommended to **avoid passive smoking**. | I | B |

## The "Five As" for a smoking cessation strategy for routine practice:

| | |
|---|---|
| **A–ASK:** | Systematically inquire about smoking status at every opportunity. |
| **A–ADVISE:** | Unequivocally urge all smokers to quit. |
| **A–ASSESS:** | Determine the person's degree of addiction and readiness to quit |
| **A–ASSIST:** | Agree on a smoking cessation strategy, including setting a quit date, behavioural counselling, and pharmacological support. |
| **A–ARRANGE:** | Arrange a schedule of follow-up. |

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# Nutrition

**Key messages:**

- Dietary habits influence the risk of CVD and other chronic diseases such as cancer.
- Energy intake should be limited to the amount of energy needed to maintain (or obtain) a healthy weight, that is, a BMI >20.0 but < 25.0 kg/m$^2$.
- In general, when following the rules for a healthy diet, no dietary supplements are needed.

The impact of diet is studied on three levels: specific **nutrients**, specific **foods/food groups** and specific **dietary patterns**, of which the **Mediterranean diet** is the most studied.

The nutrients of interest with respect to CVD are **fatty acids** (which mainly affect lipoprotein levels), **minerals** (which mainly affect BP), **vitamins and fibre**.

## Recommendation on nutrition:

| Recommendation | Class [a] | Level [b] |
|---|---|---|
| A healthy diet is recommended as a cornerstone of CVD prevention in all individuals. | I | B |

## Healthy diet characteristics:

- **SFA** to account for **<10%** of total energy intake, through replacement by **PUFA**s.
- **TFA**: **as little as possible**, preferably no intake from processed food, and **<1%** of total energy intake from natural origin.
- **<5 g** of **salt** per day
- **30–45 g** of **fibre** per day, preferably from wholegrain products.
- **≥200 g** of **fruit** per day (**2–3 servings**).
- **≥200 g** of **vegetables** per day (**2–3 servings**).
- **Fish 1–2 times per week**, one of which to be **oily** fish
- **30 grams** unsalted **nuts** per day
- Consumption of **alcoholic beverages** should be limited to **2 glasses per day** (**20 g/d** of alcohol) for **men** and **1 glass per day** (**10 g/d** of alcohol) for **women**.
- **Sugar-sweetened soft drinks** and **alcoholic beverages** consumption **must be discouraged**.

# Main dietary fatty acids

**Saturated FA**

| *Type / Definition* | *Carbon atoms* | *Common name* |
|---|---|---|
| **SFA** Fatty acids with no double bonds | 4 | Butyric acid |
| | 6 | Caproic acid |
| | 8 | Caprylic acid |
| | 10 | Capric/Caprinic acid |
| | 12 | Lauric acid |
| | 14 | Myristic acid |
| | 16 | Palmitic acid |
| | 18 | Stearic acid |

**Monounsaturated fatty acids**

| *Type / Definition* | *Carbon atoms* | *Common name* |
|---|---|---|
| **MUFA** Fatty acids with one cis double bond | C16:1 ω7 cis | Palmitoleic acid |
| | C18:1 ω9 cis | Oleic acid |

**Polyunsaturated fatty acids**

| *Type / Definition* | *Carbon atoms* | *Common name* |
|---|---|---|
| **PUFA** Fatty acids with two or more cis, cis-methylene interrupted double bonds | C18:2 ω6 | Linoleic (LA) or **omega-6** acid |
| | C18:3 ω3 | α-linolenic (ALA) or **omega-3** acid |
| | C18:3 ω6 | γ-linolenic |
| | C20:4 ω6 | Arachidonic acid |
| | C20:5 ω3 | Eicosapentaenoic (EPA) acid |
| | C22:5 ω3 | Docosapentanoic (DPA) acid |
| | C22:6 ω3 | Docosahexaenoic (DHA) acid |

**Trans fatty acids**

| *Type / Definition* | *Carbon atoms* | *Common name* |
|---|---|---|
| **TFA** FA with at least one non-conjugated (interrupted by at least one methylene group) carbon-carbon double bond in the trans configuration | C18:1 trans-9 | Elaidic acid |
| | C18:1 trans-11 | Vaccenic acid |
| | C18:2 cis-9, trans-11 | Rumenic (bovinic) acid Conjugated Linoleic Acid (CLA) |

**SCFA** (Short Chain Fatty Acids) - **<6 C**

**MCFA** (Medium Chain) – **6-12 C**

**LCFA** (Long Chain) – **14-22c**

**SCFA** and **MCFA** are important food components where they are mostly in the form of triglycerides in some **vegetable oils** and **milk**

Nevertheless, **bacterial fermentation** of amylase-resistant starch and nonstarch polysaccharides **in the gut** is probably **the most important source** of **SCFA**s in humans and most mammalian species.

https://ec.europa.eu/jrc/en/health-knowledge-gateway/promotion-prevention/nutrition/fats

It is produced industrially – by hardening of fats

Vacca = lat. Cow

Mammals convert it from Vaccenic acid. It is conjugated LA (= CLA)

## Fatty acids:

- For prevention of CVD, the types of fatty acids consumed are more important than the total fat content.
- The risk of CAD is reduced by **2–3%** when **1%** of energy intake from **SFA** is replaced by **PUFA** acids.
- The same **has not been** clearly shown for replacement with **carbohydrates** and **MUFA**s.
- **SAF** intake should be reduced to a **max of 10%** of energy intake by replacing it with **PUFA**.
- **MUFA**s have **a favourable effect on HDL-C** levels when they replace saturated fatty acids or carbohydrates, but there is **little evidence** that MUFAs **lower CAD risk**.
- **PUFA**s lower **LDL-C** levels, and to a lesser extent **HDL-C** levels, when they replace SAF.
- The **TFA** have been shown to be especially harmful due to their **unfavourable** impact on **both total cholesterol (increase) and HDL-C (decrease)**. These FA are formed during industrial processing (hardening) of fats and are present in, for example, margarine and bakery products. On average, a **2%** increase in energy intake from trans fatty acids increases CAD risk by **23%**. It is recommended to derive **<1%** of total energy intake from TFA — the less the better.
- The impact of dietary **cholesterol** on serum cholesterol levels is **weak** compared with that of the FA composition of the diet. When guidelines are followed to lower SAF intake, this usually also leads to a reduction in dietary cholesterol intake.

# Main dietary sources of various fatty acids

https://ec.europa.eu/jrc/en/health-knowledge-gateway/promotion-prevention/nutrition/fats

**Saturated fatty acids**

| Type | Dietary sources (in order of fat content) |
|---|---|
| All SFA | Coconut oil, butter (from milk fat), milk fat, cocoa butter, palm oil; smaller amounts in soybean, corn, olive, sunflower and rapeseed oil |
| SFA <12 carbons | Coconut & palm kernel oil, butter |
| Lauric | Coconut & palm kernel oil, small amounts in milk fat |
| Myristic | Coconut & palm kernel oil, milk fat, smaller amounts in butter |
| Palmitic | Palm oil, milk fat, cocoa butter, butter, smaller amounts in olive, soybean, corn, coconut & palm kernel oil |
| Stearic | Cocoa butter, milk fat, butter, small amounts in various plant oils. |

**Monounsaturated fatty acids**

| Type | Dietary sources (in order of fat content) |
|---|---|
| Oleic | Olive, rapeseed & palm oil, cocoa butter, avocado, milk fat, butter, sunflower, soybean and palm kernel oil. |

**Polyunsaturated fatty acids**

| Type | Dietary sources (in order of fat content) |
|---|---|
| Linoleic, arachidonic | Sunflower, corn, soybean, rapeseed oil; smaller amounts in olive and palm oil |
| α-Linolenic, EPA, DPA, DHA | Fatty fish and other fish from aquaculture, linseed, rapeseed oil, soybean oil, walnuts |

**Conjugated linoleic acid**

| Type | Dietary sources (in order of fat content) |
|---|---|
| Isomers of linoleic acid | Small amounts in ruminant fats and human milk |

**Trans fatty acids**

| Type | Dietary sources (in order of fat content) |
|---|---|
| iTFA (industrial origin) | Amounts are varying from 1% to up to 50% of total fat in margarine and fat spread, as well as a variety of bakery products or fried foods; today the majority of processed foods in the EU contain no or only small amounts of iTFA. However, there may be still foods (e.g. some biscuits) on the EU market with high amounts (up to 40-50% of total fat) |
| rTFA (naturally occurring, ruminant) | Small percentages (3-6% of total fatty acid content) in lamb, mutton, beef and dairy fat |

**Cholesterol**

| Type | Dietary sources (in order of fat content) |
|---|---|
| | Animal derived foods: milk/dairy fats, Butter (from milk fat), eggs, offal, pork, beef, lamb, chicken, fish, shellfish. Foods rich in cholesterol are often also rich in SFA |

***Palm oil:***
(from the flesh of oil palm fruit)

50% SFA
40% MUFA
10% PUFA

***Palm kernel oil:***
(from the kernels of palm oil fruits)

82 % SFA
16 % MUFA
2 % PUFA

# Fatty acid content in various fats

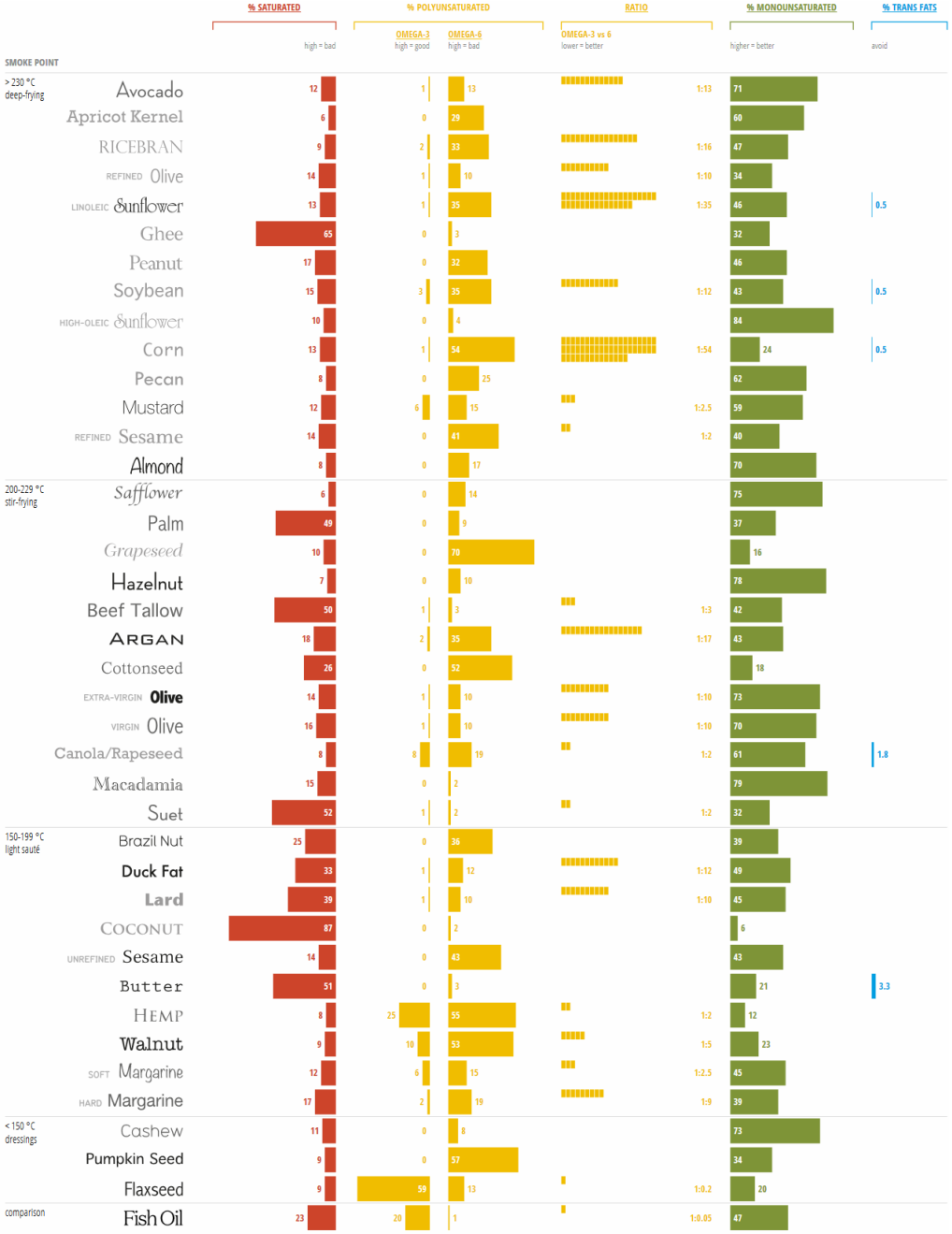
In % of total fat content

| Fat/oil | SAFA | TFA | MUFA | ω3 PUFA | ω6 PUFA | Melting point °C |
|---|---|---|---|---|---|---|
| Rapeseed | 8 | 1 | 61 | 9 | 20 | -10 |
| Sunflower | 12 | 1 | 25,5 | 0,5 | 61 | -17 |
| Soybean | 16 | 1 | 23 | 7 | 53 | -16 |
| Olive | 15 | 0 | 75 | 1 | 9 | -6 |
| Palm | 50 | 0,5 | 40 | 0 | 9,5 | 35 |
| Palm kernel | 82 | 0 | 14 | 0 | 4 | 24 |
| Coconut | 90 | 0 | 7 | 0 | 3 | 25 |
| Pork lard | 41 | 2 | 48 | 1 | 8 | 41 |
| Milk fat | 67,5 | 2,5 | 27 | 0,5 | 1,5 | 32-35 |
| Beef | 50 | 4,5 | 40 | 0,5 | 5 | 35-40 |
| Chicken | 41 | 1 | 37 | 1 | 20 | 35 |
| Fish | 28 | 0 | 52 | 15 | 5 | -70 - +15 |
| Cocoa butter | 60 | 0 | 38 | 0 | 2 | 34 |

# Composition of fats in nuts and seeds

| Nut/seed | SAFA | MUFA | ω3 PUFA | ω6 PUFA | Proteins | Carbohydrates |
|---|---|---|---|---|---|---|
| Peanuts | 6.7 | 23.8 | 0.01 | 15.4 | 24.5 | 15.8 |
| Cashew | 7.7 | 23.5 | 0.70 | 7.7 | 18.2 | 30.1 |
| Hazelnuts | 4.6 | 45.2 | 0.84 | 7.7 | 14.7 | 16.5 |
| Macadam | 11.9 | 59.5 | 0.21 | 1.3 | 7.7 | 13.7 |
| Almond | 3.9 | 30.8 | 0.70 | 11.9 | 21.0 | 21.4 |
| Brazil nuts | 15.1 | 24.5 | 0.18 | 20.3 | 14.4 | 12.3 |
| Pecan nuts | 6.3 | 40.6 | 0.98 | 20.3 | 9.1 | 13.7 |
| Pine | 4.9 | 18.6 | 1.09 | 32.9 | 13.3 | 13.0 |
| Pistachio | 5.6 | 23.8 | 0.36 | 13.0 | 20.3 | 27.3 |
| Walnuts | 6.0 | 8.8 | 8.75 | 37.5 | 15.1 | 13.7 |
| | | | | | | |
| ***Seeds:*** | | | | | | |
| Pumpkin | 8.4 | 14.0 | 1.79 | 20.3 | 32.6 | 17.5 |
| Chia | 3.3 | 2.1 | 17.15 | 5.6 | 15.4 | 43.1 |
| Linen | 3.5 | 3.9 | 22.05 | 6.0 | 6.3 | 28.4 |
| Sesame | 6.8 | 18.6 | 0.39 | 21.0 | 17.5 | 23.1 |
| Sunflower | 4.2 | 18.2 | 0.74 | 22.8 | 19.3 | 19.6 |

# Fats overview

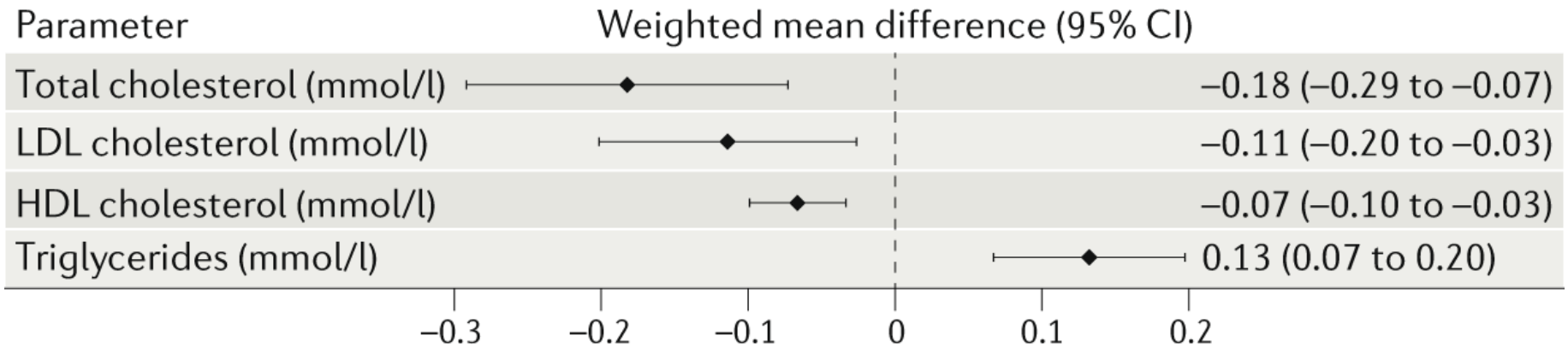





Department of Public Health
Author: Jindřich Fiala

MUNI MED

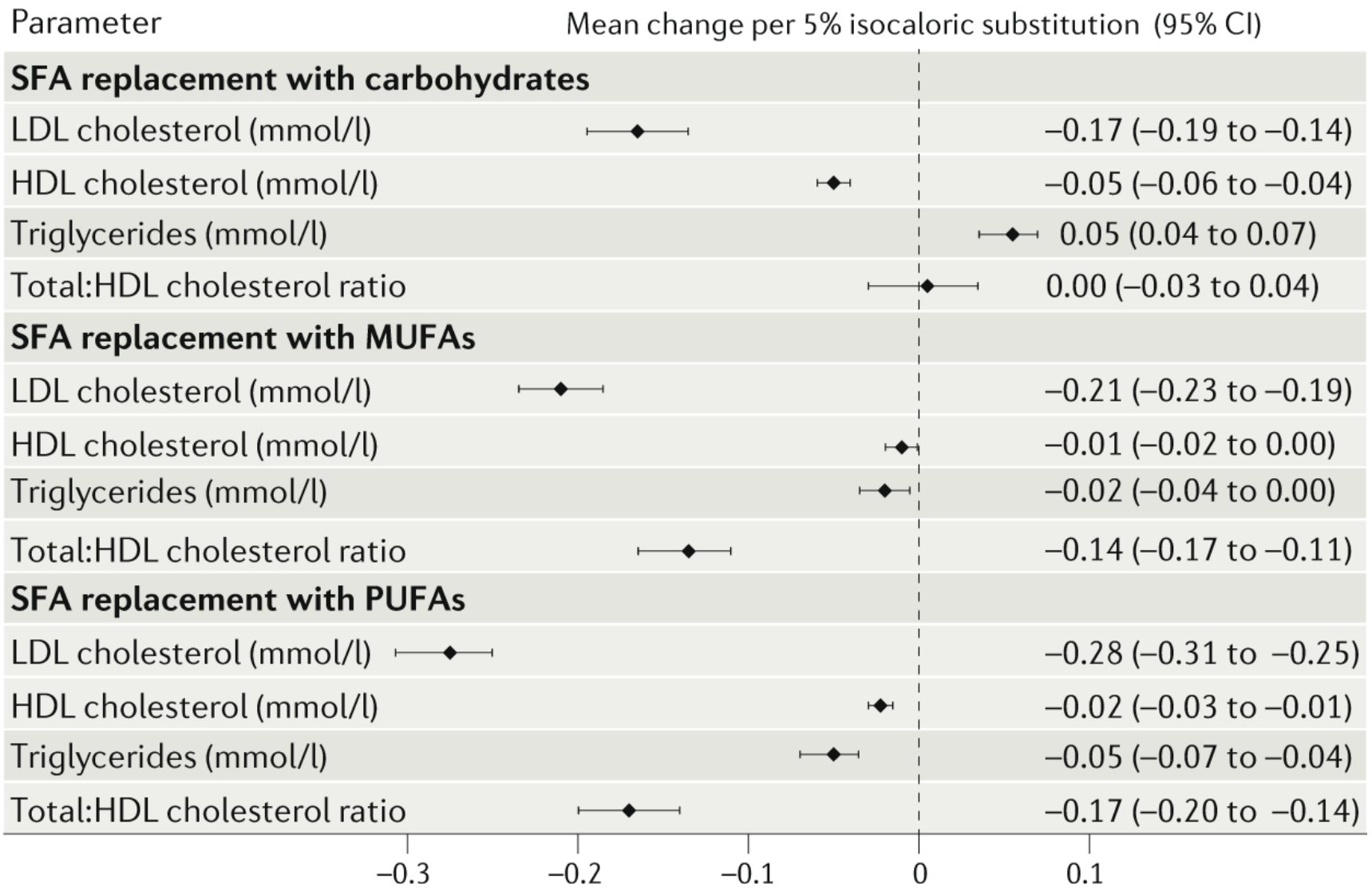
# Effect of high-fat versus low-fat diets on cardiometabolic risk factors




Differences in total fat consumption are not related to the incidence of either cardiovascular events or type 2 diabetes

Dietary fats and cardiometabolic disease: mechanisms and effects on risk factors and outcomes. Nature Reviews Cardiology,16(2019)581–6

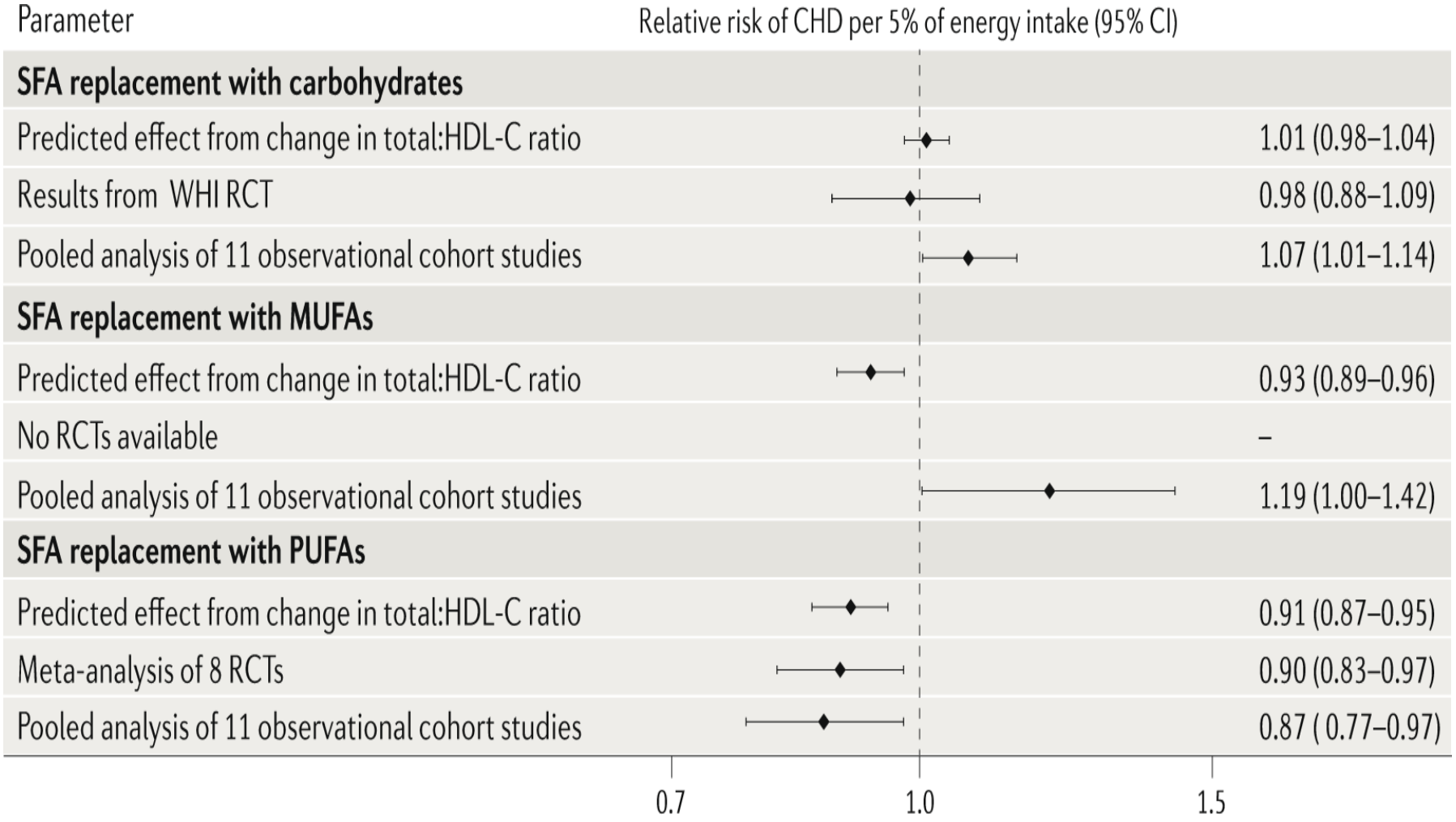
# Effect of replacement of SFA with different possibilities, (carbohydrates, MUFAs, PUFAs) on cardiometabolic risk lipid factors




Dietary fats and cardiometabolic disease: mechanisms and effects on risk factors and outcomes. Nature Reviews Cardiology,16(2019)581–601


Department of Public Health
Author: Jindřich Fiala

# Effect of replacing SFA with different alternatives (carbohydrates, MUFAs, PUFAs) on the risk of coronary heart disease



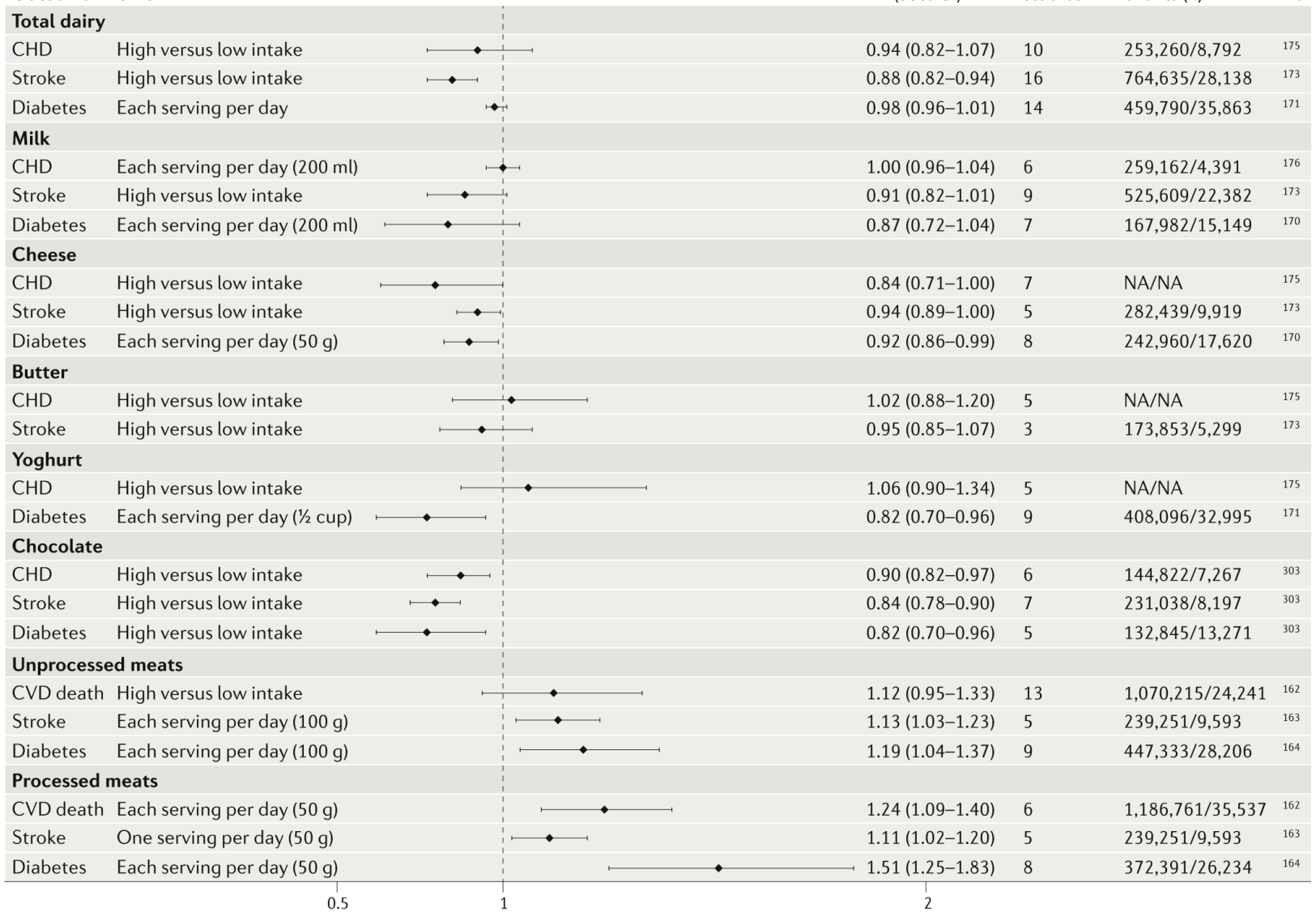

Dietary fats and cardiometabolic disease: mechanisms and effects on risk factors and outcomes. Nature Reviews Cardiology,16(2019)581–601


Department of Public Health
Author: Jindřich Fiala

# Dietary sources of saturated fats and the risk of cardiometabolic disease

Dietary fats and cardiometabolic disease: mechanisms and effects on risk factors and outcomes. Nature Reviews Cardiology,16(2019)581–601

| Outcome | Unit | RR (95% CI) | Prospective cohort studies | Participants/ events (*n*) | Ref |
|---|---|---|---|---|---|
| **Total dairy** | | | | | |
| CHD | High versus low intake | 0.94 (0.82–1.07) | 10 | 253,260/8,792 | 175 |
| Stroke | High versus low intake | 0.88 (0.82–0.94) | 16 | 764,635/28,138 | 173 |
| Diabetes | Each serving per day | 0.98 (0.96–1.01) | 14 | 459,790/35,863 | 171 |
| **Milk** | | | | | |
| CHD | Each serving per day (200 ml) | 1.00 (0.96–1.04) | 6 | 259,162/4,391 | 176 |
| Stroke | High versus low intake | 0.91 (0.82–1.01) | 9 | 525,609/22,382 | 173 |
| Diabetes | Each serving per day (200 ml) | 0.87 (0.72–1.04) | 7 | 167,982/15,149 | 170 |
| **Cheese** | | | | | |
| CHD | High versus low intake | 0.84 (0.71–1.00) | 7 | NA/NA | 175 |
| Stroke | High versus low intake | 0.94 (0.89–1.00) | 5 | 282,439/9,919 | 173 |
| Diabetes | Each serving per day (50 g) | 0.92 (0.86–0.99) | 8 | 242,960/17,620 | 170 |
| **Butter** | | | | | |
| CHD | High versus low intake | 1.02 (0.88–1.20) | 5 | NA/NA | 175 |
| Stroke | High versus low intake | 0.95 (0.85–1.07) | 3 | 173,853/5,299 | 173 |
| **Yoghurt** | | | | | |
| CHD | High versus low intake | 1.06 (0.90–1.34) | 5 | NA/NA | 175 |
| Diabetes | Each serving per day (½ cup) | 0.82 (0.70–0.96) | 9 | 408,096/32,995 | 171 |
| **Chocolate** | | | | | |
| CHD | High versus low intake | 0.90 (0.82–0.97) | 6 | 144,822/7,267 | 303 |
| Stroke | High versus low intake | 0.84 (0.78–0.90) | 7 | 231,038/8,197 | 303 |
| Diabetes | High versus low intake | 0.82 (0.70–0.96) | 5 | 132,845/13,271 | 303 |
| **Unprocessed meats** | | | | | |
| CVD death | High versus low intake | 1.12 (0.95–1.33) | 13 | 1,070,215/24,241 | 162 |
| Stroke | Each serving per day (100 g) | 1.13 (1.03–1.23) | 5 | 239,251/9,593 | 163 |
| Diabetes | Each serving per day (100 g) | 1.19 (1.04–1.37) | 9 | 447,333/28,206 | 164 |
| **Processed meats** | | | | | |
| CVD death | Each serving per day (50 g) | 1.24 (1.09–1.40) | 6 | 1,186,761/35,537 | 162 |
| Stroke | One serving per day (50 g) | 1.11 (1.02–1.20) | 5 | 239,251/9,593 | 163 |
| Diabetes | Each serving per day (50 g) | 1.51 (1.25–1.83) | 8 | 372,391/26,234 | 164 |





Department of Public Health
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# Nutrition - minerals

## Sodium - Na:

- Even a modest reduction in sodium intake of **1 g/day** reduces SBP by **3.1 mmHg** in hypertensive patients and **1.6 mmHg** in normotensive patients.
- The Dietary Approaches to Stop Hypertension (**DASH**) trial showed **a dose–response relation** between **sodium reduction** and **BP reduction**.
- In most western countries, salt intake is high **(~9–10 g/day**), whereas the recommended maximum intake is **5 g/day**. Optimal intake levels might be as low as **3 g/day**.
- Although the relation between salt intake and BP remains controversial, the totality of evidence warrants **salt reduction as an important way to prevent CAD and stroke**.
- On average, **80% of salt intake** comes from **processed foods**, while only **20%** is **added** later on. Salt reduction can be achieved by making different dietary choices (fewer processed foods, more basic foods) and the reformulation of foods (lowering salt content)

## Potassium - K:

- Potassium has **favourable effects on BP**. The main sources of potassium are **fruits and vegetables**. An inverse statistically significant association exists between potassium intake and the risk of incident stroke [RR 0.76 (95% CI 0.66, 0.89)]. Apart from reducing sodium intake, **increasing potassium intake** contributes to the **lowering of BP**.

# Nutrition - Vitamins

## Vitamins A and E:

- Many case–control and prospective observational studies have observed **inverse associations** between levels of vitamin **A** and **E** and the **risk of CVD**. However, intervention trials have **failed to confirm** these observational studies.

## Vitamins B and C:

- Also, for the **B** vitamins (**B6**, **folic acid** and **B12**) and vitamin **C**, trials have shown **no beneficial effects**.
- In the **bottom tertile** of serum levels of **vitamin D**, CV and total **mortality** is **35% higher** [RR 1.35 (95% CI 1.13, 1.61)] than in the highest tertile.

## Vitamin D:

- A **41%** higher risk of CV **mortality** [RR 1.41 (95% CI 1.18, 1.68)] and **57%** higher risk of all-cause mortality [RR 1.57 (95% CI 1.36, 1.81)] has been reported in the **lowest vs. highest quintile**.
- A much smaller effect was observed in RCTs: an **11%** risk **reduction** in all-cause **mortality** was observed for vitamin **D3 supplementation** [RR 0.89 (95% CI 0.80, 0.99)], but **not for vitamin D2** supplementation.
- Due to a lack of power, it was not possible to look at CV mortality specifically. Therefore, conclusions about vitamin D supplementation [type of supplement (D2 or D3), dosage and duration] for CV prevention **cannot yet be drawn**.

# Nutrition - Fibre

## Fibre:

- Recent meta-analyses of prospective cohort studies show that a **7 g/ day** higher intake of total fibre is associated with a **9%** lower risk of CAD [RR 0.91 (95% CI 0.87, 0.94)]
- A **10 g/day** higher fibre intake is associated with a **16%** lower risk of **stroke** [RR 0.84 (95% CI 0.75, 0.94)] and a **6%** lower risk of **type 2 DM** [RR 0.94 (95% CI 0.91, 0.97)].
- There is **no evidence** yet for a similar association with **fibre from fruits and vegetables**.
- Although the mechanism has not been elucidated completely, it is known that a high fibre intake reduces **postprandial glucose responses** after carbohydrate-rich meals and lowers **total cholesterol** and **LDL-C** levels.

# Nutrition – fruit and vegetables, nuts

## Fruit and vegetables:

- Prospective cohort studies have shown a **protective effect** of the consumption of fruits and vegetables on CVD, but **RCTs are scarce**.
- A meta-analysis reported a **decrease of 4%** [RR 0.96 (95% CI 0.92, 0.99)] in **CV mortality** for **each additional serving of fruits (equivalent to 77 g)** and **vegetables (equivalent to 80 g)** per day, while all-cause mortality did not reduce further with intakes of more than five servings.
- A meta-analysis reported a risk reduction for **stroke** of **11%** [RR 0.89 (95% CI 0.83, 0.97)] **for three to five daily servings of fruits and vegetables** and of **26%** [RR 0.74 (95% CI 0.69, 0.79)] for **more than five servings** compared with **less than three servings**.
- A meta-analysis on **CAD** reported a **4%** decrease in CAD risk [RR 0.96 (95% CI 0.93, 0.99)] for **each additional serving of fruits and vegetables** per day.

## Nuts:

- A meta-analysis of prospective cohort studies has shown that daily consumption of **30 g** of nuts reduces the risk of CVD by ≈**30%** [RR 0.71 (95% CI 0.59, 0.85)]. It must be noted that the energy density of nuts is high.

# Nutrition - Fish

## Fish:

- The protective effect of fish on CVD is attributed to the **n-3 fatty acid content**.
- Pooled risk estimates from prospective cohort studies show that eating fish at least **once a week** results in a **16% reduction in the risk of CAD** [RR 0.85 (95% CI 0.75, 0.95)] compared with eating less fish.
- A recent meta-analysis showed that eating fish **two to four times a week** reduces the **risk of stroke by 6%** [RR 0.94 (95% CI 0.90, 0.98)] compared with eating fish less than once a week.
- The relation between fish intake and CV risk is **not linear**. Especially in the range of **no or very low** intake, **risk is increased**. The public health **impact of a small increase in fish consumption** in the general population is therefore potentially **large**.
- For fish oil, three randomized controlled prevention trials have been published. All three trials, in post-AMI or CAD patients who received an extra amount of **400–1000 g EPA/DHA daily**, **did not observe a reduction in CV events** in the intervention group.
- A recent meta-analysis of 20 trials, mostly prevention of recurrent CV events and mostly using fish oil supplements, showed **no benefit of fish oil supplementation on CV outcomes**.

# Alcohol

## Alcohol:

- Drinking **three or more** alcoholic beverages per day is associated with **elevated CVD risk**.
- Results from epidemiological studies **suggest a lower risk of CVD** occurring with moderate (**one to two units per day**) alcohol consumption compared with non-drinkers.
- This association appears not to be explained by special characteristics of abstainers, although the **potential for residual confounding and reverse causality cannot be fully excluded**.
- Moreover, a recent Mendelian randomization study including analyses from 59 epidemiological studies **has shed doubt on any beneficial effect of moderate alcohol consumption**, suggesting that the lowest risks for CV outcomes were in abstainers and that **any amount of alcohol** is associated with **elevated BP** and **BMI**.

## Soft drinks and sugar

- **Sugar-sweetened soft drinks** are the **largest single food source of calories in the US diet** and are important in Europe. In children and adolescents, beverages may now even account for **10–15% of the calories consumed**.
- Regular consumption of soft drinks has been associated with **overweight**, **metabolic syndrome** and **type 2 DM**.
- Substitution of sugar-sweetened soft drinks with artificially sweetened drinks resulted in less weight gain in children over an 18-month period. Sugar-sweetened beverages also cause **weight gain in adults**.
- Regular consumption of **sugar-sweetened beverages** (i.e. two servings per day compared with one serving per month) was associated with a **35% higher risk of CAD** in women, even after other unhealthy lifestyle and dietary factors were accounted for, whereas artificially sweetened beverages were not associated with CAD.
- The **WHO guideline** recommends a **maximum intake of 10% of energy from sugar** (mono- and disaccharides), which includes added sugars as well as sugars present in fruits and fruit juices.

# Dietary patterns (Mediterranean diet), functional foods

## Dietary patterns:

- Studying the impact of a **total dietary pattern** theoretically shows the **full preventive potential of diet** since it yields a **combined estimate of the impact of several favourable dietary habits**.
- The **Mediterranean diet** comprises many of the nutrients and foods that have been discussed previously:
  - high intake of fruits, vegetables, legumes, wholegrain products,
  - fish and unsaturated fatty acids (especially olive oil);
  - moderate consumption of alcohol (mostly wine, preferably consumed with meals)
  - and low consumption of (red) meat, high-fat dairy products and saturated fatty acids.
- A meta-analysis of prospective cohort studies has demonstrated that greater adherence to a Mediterranean diet is associated with a **10% reduction in CV incidence or mortality** [pooled RR 0.90 (95% CI 0.87, 0.93)] and an **8% reduction in all-cause mortality** [pooled RR 0.92 (95% CI 0.90, 0.94)].
- An RCT in **high-risk individuals** suggested that following a Mediterranean diet over a 5 years period, compared with a control diet, was related to a **29% lower risk of CVD** [RR 0.71 (95% CI 0.56, 0.90)].

## Functional foods:

- Functional foods containing **phytosterols** (plant sterols and stanols) are effective in lowering LDL-C levels by an average of **10%** when consumed in amounts of **2 g/day**.
- The cholesterol-lowering effect is **in addition** to that obtained with a **diet** or use of **statins**.
- **Further cholesterol reduction** can be obtained with **higher doses** of phytosterols.
- No studies with clinical endpoints have been performed yet.

# Body weight

**Key messages**

- Both overweight and obesity are associated with an increased risk of CVD death and all-cause mortality. All-cause mortality is lowest with a BMI of 20–25 kg/m$^2$ (in those <60 years of age); further weight reduction cannot be considered protective against CVD
- Healthy weight in the elderly is higher than in the young and middle-aged.
- Achieving and maintaining a healthy weight has a favourable effect on metabolic risk factors (BP, blood lipids, glucose tolerance) and lower CV risk.

Counseling in lifestyle oriented prevention - ASCVD prevention

## Recommendation for body weight:

| Recommendation | Class | Level |
|---|---|---|
| • It is recommended that subjects with healthy weight[1] maintain their weight.<br>• It is recommended that overweight and obese people achieve a healthy weight (or aim for a reduction in weight) in order to reduce:<br>○ BP,<br>○ Dyslipidaemia<br>○ and risk of developing type 2 DM,<br>and thus improve the CV risk. | I | A |

[1]BMI 20–25 kg/m2. There is evidence that optimal weight in elderly is higher than in the young and middle-aged.

**Does 'metabolically healthy obesity' exist?**

- The phenotype of 'metabolically healthy obesity' (MHO), defined by the presence of obesity in the absence of metabolic risk factors, has gained a lot of interest.
- Some studies argue that a specific subgroup of obese individuals is resistant to metabolic complications such as arterial hypertension and insulin resistance.
- However, MHO individuals present a higher all-cause mortality compared with normal weight metabolically healthy individuals.[343,344]
- Long-term results from the Whitehall study support the notion that MHO is a transient phase[345] moving towards glucometabolic abnormalities rather than a specific 'state'

# Lipid control

**Key messages**

- Elevated levels of plasma LDL-C are causal to atherosclerosis.
- Reduction of LDL-C decreases CV events.
- Low HDL-C is associated with increased CV risk, but manoeuvres to increase HDL-C have not been associated with a decreased CV risk.
- Lifestyle and dietary changes are recommended for all.
- Total CV risk should guide the intensity of the intervention.
- Total cholesterol and HDL-C are adequately measured on nonfasting samples, thus allowing non-HDL-C to be derived.

Each 1.0 mmol / l reduction in LDL-C reduces by 20-25% CVD mortality and the incidence of non-fatal MI.

**Recommendations for lipid control:**

| Recommendations | Class | Level |
|---|---|---|
| In subjects at **VERY HIGH CV risk**, an **LDL-C** goal **<1.8 mmol/L** (<70 mg/dL), or a reduction of at least **50%** if the baseline is between 1.8 and 3.5 mmol/L (70 and 135 mg/ dL) is recommended. | I | B |
| In subjects at **HIGH CV risk**, an **LDL-C** goal **<2.6 mmol/L** (<100 mg/dL), or a reduction of at least **50%** if the baseline is between 2.6 and 5.1 mmol/L (100 and 200 mg/dL) is recommended. | I | B |
| In the **remaining subjects** on LDL-C lowering treatment, an LDL-C goal **<3.0 mmol/L** (<115 mg/dL) should be considered. | IIa | C |

| Total CV risk (SCORE) % | LDL-C levels | | | | |
|---|---|---|---|---|---|
| | <1.8 mmol/L | 1.8 to <2.6 mmol/L | 2.6 to <4.0 mmol/L | 4.0 to <4.9 mmol/L | ≥4.9 mmol/L |
| <1 | **Lifestyle advice** | **Lifestyle advice** | **Lifestyle advice** | **Lifestyle advice** | Lifestyle advice, consider drug if uncontrolled |
| ≥1 to <5 | **Lifestyle advice** | **Lifestyle advice** | Lifestyle advice, consider drug if uncontrolled | Lifestyle advice, consider drug if uncontrolled | Lifestyle advice, consider drug if uncontrolled |
| ≥5 to <10 or high-risk | **Lifestyle advice** | Lifestyle advice, consider drug if uncontrolled | Lifestyle advice and drug treatment for most | Lifestyle advice and drug treatment | Lifestyle advice and drug treatment |
| ≥10 or very high-risk | Lifestyle advice, consider drug if Uncontrolled | Lifestyle advice and concomitant drug treatment | Lifestyle advice and concomitant drug treatment | Lifestyle advice and concomitant drug treatment | Lifestyle advice and concomitant drug treatment |

*Norm in FN Brno:*
Chol: 2.9 - 5.0
TG: 0.45 - 1,7
HDL-C 1,0 - 2,1
**LDL-C** 1,2 - **3,0**

# Non-pharmacological reduction of blood cholesterol - I. Nutrition

- **Reduce saturated fats**
  - Saturated fats, found primarily in **red meat** and **full-fat dairy products (+coconut fat)**, raise total cholesterol. Decreasing consumption of SFA reduce your LDL cholesterol.
- **Eliminate trans fats**
  - Trans fats (industrially produced) raise overall cholesterol levels.
  - TFAs, sometimes listed on food labels as "partially hydrogenated vegetable oil," are often used in margarines and **store-bought cookies**, **crackers** and **cakes**. Trans fats raise overall cholesterol levels.
  - The FDA (Food and Drug Administration) has banned the use of partially hydrogenated vegetable oils by Jan. 1, 2021.
- **Increase soluble fiber**
  - Soluble fiber **reduce the absorption from intestine**, thereby lowering its blood level.
  - It is found in such foods as **oatmeal**, **kidney beans**, **Brussels sprouts**, **apples** and **pears**.
- **Add whey protein**
  - Whey protein, **lowers** both **LDL** cholesterol **and total cholesterol** as well as **BP**
  - It is found in dairy products. It can be obtained by removing casein from the milk when a solid component (casein, curd) and a **liquid whey** are formed after clotting
  - It can cause a number of health benefits that dairy products have.
  - Compared to other protein sources, it contains relatively more BCAA - Branched Chain Amino Acids (valine, isoleucine and leucine)
- **Fytosterols**
  - Plant sterols, naturally occurring in plant membranes. Due to a similar structure, they compete with cholesterol for absorption (reabsorption) in the intestine.
  - Intake of **2g/day** reduces **total cholesterol** by **10 %** and **LDL-C** by **14 %.**
  - They occur naturally, especially in vegetable oils, nuts, pulses, whole grains, fruits and vegetables, but the average intake is <0.5 g, i.e. **supplementation** (or food fortification) is required.
- **Soya, soya products**
  - Intake of soy products leads to a significant reduction in LDL-C, TAG and total cholesterol (TC). It also leads to a significant increase in HDL-C (Metaanalysis RCT, 2015).
  - The effect is caused by soy proteins. The effect is stronger in hypercholesterolomic subjects. Soy products are more effective than soy supplements.
- **Foods rich in omega-3 FA**
  - Omega-3 fatty acids **don't affect LDL cholesterol.** But they have **other heart-healthy benefits**, including reducing blood pressure. Foods with omega-3 fatty acids include salmon, mackerel, herring, walnuts and flaxseeds.

# Non-pharmacological lowering of blood cholesterol - continued

- **Physical activity**
  - Physical activity **increases HDL-C** and **lowers total cholesterol**.
  - Exercise (engage in sports, physical activity) **most days of the week** and **increase your physical activity**.
- **Smoking**
  - Smoking **reduces HDL-C**, quitting smoking improves HDL-C and thus lipid profile and can lower total cholesterol.
  - In addition, it is itself **the most important cardiovascular risk factor** and **modifies the effect of cholesterol as RF**
- **Body weight**
  - Excessive weight contributes to high cholesterol.
  - Reducing excessive weight reduces LDL-C and improves its reduction
- **Alcohol**
  - Moderate alcohol consumption is associated with higher HDL-C levels, but the benefit is not strong enough to justify recommending alcohol to anyone who is no longer drinking.
  - If you drink alcohol, do it in moderation. For healthy adults, this is a maximum of **1 drink/ day** for **women** of all ages and for **men ≥65** and up to **2 drinks/day** for **men under 65**.
  - Too much alcohol leads to serious health problems, including **hypertension**, heart failure, stroke.

# Blood pressure

**Key messages**

- Elevated BP is a major risk factor for CAD, HF, cerebrovascular disease, PAD, CKD and AF.
- The decision to start BP-lowering treatment depends on the BP level and total CV risk.
- Benefits of treatment are mainly driven by BP reduction per se, not by drug type.
- Combination treatment is needed to control BP in most patients

- Office BP is recommended for screening and diagnosis of hypertension, which should be based on **at least two BP measurements per visit** and on **at least two visits**.
- If the BP is only slightly elevated, **repeated measurements** should be made over a period of **several months** to achieve an acceptable definition of the individual's 'usual' BP and to decide about initiating drug treatment.

## Definition and classification of blood pressure levels

| Category | Systolic BP (mmHg) | | Diastolic BP (mmHg) |
|---|---|---|---|
| Optimal | <120 | and | <80 |
| Normal | 120–129 | and/or | 80–84 |
| High-normal | 130–139 | and/or | 85–89 |
| Grade 1 hypertension | 140–159 | and/or | 90–99 |
| Grade 2 hypertension | 160–179 | and/or | 100–109 |
| Grade 3 hypertension | ≥180 | and/or | ≥110 |
| Isolated systolic hypertension | ≥140 | and | <90 |

Blood pressure thresholds for definition of hypertension with different types of BP measurement:

| | SBP (mmHg) | DBP (mmHg) |
|---|---|---|
| Office or clinic | 140 | 90 |
| 24-hour | 125–130 | 80 |
| Day | 130–135 | 85 |
| Night | 120 | 70 |
| Home | 130–135 | 85 |

## Recommendation for management of hypertension:

| Recommendations | Class | Level |
|---|---|---|
| **Lifestyle measures** (***weight control***, ***increased physical activity***, ***alcohol moderation***, **sodium restriction**, and increased consumption of ***fruits, vegetables***, and ***low-fat dairy products***) are recommended in **all patients with hypertension** and in individuals **with high normal BP**. | I | A |
| In **asymptomatic subjects with hypertension** but free of CVD, CKD, and DM, total CV **risk stratification using the SCORE** model is recommended. | I | A |
| **Drug treatment** is recommended in patients with **grade 3 hypertension** irrespective of CV risk, as well as in patients with **grade 1 or 2 hypertension** who are at **very high CV risk**. | I | B |
| **Drug treatment** should be considered in patients with **grade 1 or 2** hypertension who are **at high CV risk**. | IIa | B |
| In patients at **low to moderate total CV risk** and with **grade 1 or 2** hypertension, **lifestyle measures are recommended**. | I | B |
| In patients at **low to moderate total CV risk** and with **grade 1 or 2** hypertension, **if lifestyle measures fail** to reduce BP, **drug treatment may be considered.** | IIb | B |
| SBP **<140** mmHg and DBP **<90** mmHg are recommended in all treated hypertensive patients **<60 years** old. | I | B |
| In patients **>60 years** old with SBP ≥160 mmHg, it is recommended to reduce SBP to between **150 and 140** mmHg. | I | B |

## Lifestyle intervention:

- **Lifestyle interventions**, weight control and regular PA **alone may be sufficient** for patients with **high-normal** and grade 1 hypertension, and **should always be advised for patients receiving BP-lowering drugs**, as these **may reduce the dosage** of BP-lowering drugs needed to achieve BP control.
- The lifestyle intervention **specific** to hypertension is **salt restriction**. At the individual level, effective salt reduction is by no means easy to achieve. As a minimum, advice should be given to avoid added salt and high-salt food.

# Non-pharmacological means to reduce high blood pressure

- **Natrium**
  - Even a slight decrease in sodium intake of **1 g/day** reduces syst. BP in patients with hypertension by **3.1 mmHg** and in patients with normotension by **1.6 mmHg**.
  - A study of Dietary Approaches to Stop Hypertension (DASH) showed a **dose-response relationship** between sodium reduction and BP reduction.
  - The recommended **maximum intake** of **NaCl** is **5 g/day**. The **optimal** level is around **3 g/day**.
  - **80 %** of salt intake comes from processed foods, while only **20 %** is added later.
  - *Standard DASH* (Mayo): Allows intake of max. **2.3 g Na** (= **5.75 g NaCl** per day).
  - *Low sodium DASH*: Permits max. **1.5 g Na** per day **(= 3.75 g NaCl**)
- **Dairy products (low fat)**

  ***Bioactive peptides:***
  - **Casein** and **whey protein** contain specific bioactive peptides that have been shown to have an **ACE (Angiotensin I converting enzyme) inhibitory effect**, a *key process in BP control*.
  - Certain combinations of peptides in milk have hypotensive effects also through **modulation of endothelin-1 release** by endothelial cells.
  - For **cheese, casein-derived bioactive peptides** are relevant; for example, the specific **tripeptides isoleucine-proline-proline** (Ile-Pro-Pro) and **valine-proline-proline** (Val-Pro-Pro) have been shown to have antihypertensive activity. Significant reductions of **4.8 mmHg** in **systolic BP** and 2.2 mmHg in **diast BP** were found.

  ***Calcium:***
  - Ca is considered to be one of the major nutrients responsible for the beneficial impact of dairy products on BP control.
  - Calcium contributes to the regulation of blood pressure by controlling the contractility of vascular smooth muscle cells and thereby modulating peripheral vascular resistance.
  - In addition, extracellular ionized calcium inhibits renin secretion by interaction with the calcium receptor
  - Other minerals in milk, such as magnesium and potassium, may also help regulate BP, but their individual contributions are difficult to isolate because they are often found in calcium-rich foods.
- **Potassium - fruits and vegetables**
  - Potassium has beneficial effects on BP (well documented, eg by DASH). The main sources of potassium **are fruits and vegetables.**
- **Physical activity**
  - Regular physical activity is important for maintaining normal BP, it can significantly reduce BP.
- **Body weight control**
  - Excessive weight significantly increases BP. Weight reduction significantly reduces BP
- **Alcohol**
  - Any alcohol consumption increases BP

# DASH – Dietary Approaches to Stop Hypertension

- DASH diet originated in the 1990s. In 1992, the NIH (National Institute of Health, USA) began organizing research to determine if a particular nutritional intervention was useful in treating hypertension. They found that nutritional intervention alone was able to reduce blood pressure by 6-11 mmHg.
- DASH is also a way to prevent hypertension.
- The main essence of the DASH diet is **to reduce the Na** content in the diet and consume various foods rich in nutrients that help lower blood pressure, such as **potassium, calcium and magnesium**.
- It is rich in **vegetables, whole grains, fruits, fish, meat, poultry, nuts, beans** and **low-fat dairy products.**

The DASH meal plan does not require any special meals and instead provides daily and weekly nutritional goals. This plan recommends:

- To Eat **vegetables, fruits** and **wholegrains**
- Including **non-fat or low-fat dairy products, fish, poultry, beans, nuts** and **vegetable oils**
- Reducing foods high in saturated fat, such as fatty meats, whole milk products and tropical oils such as coconut, palm kernel and palm oil.
- Reducing **sugar sweetened beverages** and **sweets**

## Sodium intake reduction:

- Standard DASH: Allows intake of max. **2.3 g Na** (= **5.75 g NaCl** per day).
- Low sodium DASH: Permits max. **1.5 g Na** per day (= **3.75 g NaCl**).

The DASH diet is a lifelong approach to healthy eating that is designed to treat or prevent high blood pressure

## Dairy products:

- They are important for the intake of **bioactive peptides** and **calcium**, lowering blood pressure

## Fruits and vegetables:

- They are important for a sufficient intake of **potassium** lowering blood pressure

***Example of food composition:***

- Wholegrains: 6 to 8 servings per day
- Vegetables: 4 to 5 servings a day
- Fruit: 4 to 5 servings per day
- Dairy products: 2 to 3 servings a day
- Lean meat, poultry and fish: 1 serving or less per day

# The effect of non-pharmacological means to reduce high blood pressure

| Modification | Recommendation | Approximate BP reduction (range) |
|---|---|---|
| **Weight reduction** | **Maintain normal body weight (BMI 18.5 – 24.9)** | **5-20** mmHg/10 kg weight loss |
| **DASH eating plan** | **Consume a diet rich i fruits, vegetables, and lowfat dairy products with a reduced content of saturated and total fat.** | **8-14** mmHg |
| **Dietary sodium reduction** | **Reduce dietary sodium to no more than 2.3 g (5.75 g NaCl)** | **2-8** mmHg |
| **Physical activity** | **Engage in aerobic physical aktivity such as brisk walking (at least 30 min per day, most days of week).** | **4-9** mmHg |
| **Moderation of alcohol** | **Limit consumption to no more tahn 2 drinks (1 oz or 30 mL ethanol; e.g., 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey) per day in most men and to no more than 1 drink per day in women and lighter weight persons.** | **2-4** mmHg |

Adopted from: Chobanian et al 2003 (The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure

# Risk factor goals and target levels for important cardiovascular risk factors

2016 European guidelines on CD prevention in clinical practice

| | |
|---|---|
| **Smoking** | **No exposure** to tobacco in any form. |
| **Diet** | **Low in saturated fat** with a focus on **wholegrain products**, **vegetables**, **fruit** and **fish**. |
| **Physical activity** | At least **150 minutes** a week of moderate aerobic PA (**30 minutes for 5 days/week**) or **75 minutes a week** of **vigorous** aerobic PA (**15 minutes for 5 days/week**) or a combination thereof. |
| **Body weight** | **BMI 20–25** kg/m$^2$. **Waist circumference <94 cm** (men) or **<80** cm (women). |
| **Blood pressure** | <**140/90** mmHg[a] |
| **Lipids**[b] | |
| **LDL-C**[c] is the primary target | ***Very high-risk:* <1.8 mmol/l** (<70 mg/dl), or a reduction of at least 50 % if the baseline is between 1.8 and 3.5 mmol/l (70 and 135 mg/dl)[d]<br>***High-risk:* <2.6mmol/l** (<100 mg/dl), or a reduction of at least 50% if the baseline is between 2.6 and 5.1 mmol/l (100 and 200 mg/dl)<br>***Low to moderate risk*: <3.0 mmol/l** (<115 mg/dl). |
| **HDL-C** | No target but **>1.0 mmol/l** (>40mg/dl) in **men** and **>1.2 mmol/l** (>45 mg/dl) in **women** indicate lower risk. |
| **Triglycerides** | No target but **<1.7 mmol/l** (<150 mg/dl) indicates lower risk and higher levels indicate a need to look for other risk factors. |
| **Diabetes** | HbA1c <7% (<53 mmol/mol) |

BMI = body mass index; HbA1c = glycated haemoglobin; HDL-C = high-density lipoprotein cholesterol; LDL-C = low density lipoprotein cholesterol.

[a]Blood pressure <140/90 mmHg is the general target. The target can be higher in frail elderly, or lower in most patients with DM and in some (very) high-risk patients without DM who can tolerate multiple blood pressure lowering drugs.

[b]Non-HDL-C is a reasonable and practical alternative target because it does not require fasting. Non HDL-C secondary targets of < 2.6, < 3.3 and <3.8 mmol/L (<100, <130 and <145 mg/dL) are recommended for very high, high and low to moderate risk subjects, respectively.

[c]A view was expressed that primary care physicians might prefer a single general LDL-C goal of 2.6 mmol/L (100 mg/dL). While accepting the simplicity of this approach and that it could be useful in some settings, there is better scientific support for the three targets matched to level of risk.

[b]This is the general recommendation for those at very high-risk. It should be noted that the evidence for patients with CKD is less strong.

# Intervention of risk factors at individual level - behavioral change

***Key message***

• Cognitive behavioural methods are effective in supporting persons in adopting a healthy lifestyle.

Lifestyle' is usually based **on long-standing behavioural patterns** that are **maintained by social environment**. Individual and environmental factors **impede** the ability to adopt a healthy lifestyle, as does complex or confusing advice from caregivers

- It is important to explore each patient's **experiences, thoughts**, **worries**, **previous knowledge** and **circumstances** of **everyday life**. **Individualized counselling** is the basis **for motivation** and **commitment**.
- Decision-making should be shared between the caregiver and patient (including also the individual's spouse and family).
- Use of the principles of effective communication236 (Table 8) will facilitate treatment and prevention of CVD

**Recommendations for facilitating changes in behaviour**:

[a]Class of recommendation.
[b]Level of evidence.

| Recommendations | Class[a] | Level[b] |
|---|---|---|
| Established cognitive-behavioural strategies (e.g. motivational interviewing) to facilitate lifestyle change are recommended. | I | A |
| Involvement of multidisciplinary healthcare professionals (e.g. nurses, dieticians, psychologists) is recommended. | I | A |
| In individuals at very high CVD risk, multimodal interventions integrating medical resources with education on healthy lifestyle, physical activity, stress management and counselling on psychosocial risk factors, are recommended. | I | A |

**Class of recommendations:**

| Classes of recommendations | Definition | Suggested wording to use |
|---|---|---|
| Class I | Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective. | Is recommended/is indicated |
| Class II | Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure. | |
| *Class IIa* | *Weight of evidence/opinion is in favour of usefulness/efficacy.* | Should be considered |
| *Class IIb* | *Usefulness/efficacy is less well established by evidence/opinion.* | May be considered |
| Class III | Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful. | Is not recommended |

**Level of evidence**

| | |
|---|---|
| Level of evidence A | Data derived from multiple randomized clinical trials or meta-analyses. |
| Level of evidence B | Data derived from a single randomized clinical trial or large non-randomized studies. |
| Level of evidence C | Consensus of opinion of the experts and/or small studies, retrospective studies, registries. |


Department of Public Health
Author: Jindřich Fiala

# Risk factors intervention at the individual level - behavioural change

## Principles of effective communication to facilitate behavioural change:

- Spend enough time with the individual to create a therapeutic relationship – even a few more minutes can make a difference.
- Acknowledge the individual's personal view of his/her disease and contributing factors.
- Encourage expression of worries and anxieties, concerns and self-evaluation of motivation for behaviour change and chances of success.
- Speak to the individual in his/her own language and be supportive of every improvement in lifestyle.
- Ask questions to check that the individual has understood the advice and has any support he or she requires to follow it.
- Acknowledge that changing life-long habits can be difficult and that sustained gradual change is often more permanent than a rapid change.
- Accept that individuals may need support for a long time and that repeated efforts to encourage and maintain lifestyle change may be necessary in many individuals.
- Make sure that all health professionals involved provide consistent information.

## Ten strategic steps to facilitate behaviour change:

1. Develop a therapeutic alliance.
2. Counsel all individuals at risk of or with manifest cardiovascular disease
3. Assist individuals to understand the relationship between their behaviour and health.
4. Help individuals assess the barriers to behaviour change.
5. Gain commitments from individuals to own their behaviour change.
6. Involve individuals in identifying and selecting the risk factors to change.
7. Use a combination of strategies including reinforcement of the individual's capacity for change.
8. Design a lifestyle-modification plan.
9. Involve other healthcare staff whenever possible.
10. Monitor progress through follow-up contact.