# **CHS 269 Lectures (5-7)**

**Diet and CARDIOVASCULAR DISEASE (CVD)**

# EPIDEMIOLOGY OF CARDIOVASCULAR DISEASE (CVD)

# „Cardiovascular disease has the same meaning for health care today as the epidemics of centuries had for medicine in earlier times: 50% of the population in developed countries die of cardiovascular disease” Someone has a heart attack every two minutes .

# **Public Health Significance**

## **- Leading cause of mortality in developed countries and a rising tendency in developing countries (disease of civilization)**

## **- A major impact on life expectancy**

## **- Significantly contributes to morbidity and death rates in the middle aged population: potential life years lost, common cause of premature death, labor force (economic costs), family life**

## **- Contributes to deterioration of the quality of life**

# **Types of Cardiovascular Disease**

## **- Coronary heart disease (CHD, ischemic heart disease, heart attack, myocardial infarction, angina pectoris)**

## **- Cerebrovascular disease (stroke, TIA, transient ischemic attack)**

## **- Hypertensive heart disease**

## **- Peripheral vascular disease**

## **- Heart failure**

## **- Rheumatic heart disease (streptococcal infection)**

## **- Congenital heart disease**

## **- Cardiomyopathies**

# **Tasks of Cardiovascular Epidemiology**

## **- Detection of the occurrence and distribution of CVD in populations, monitoring, trends of changes**

## **- Study of the natural history of CVD**

## **- Formulation and testing of etiological hypotheses (risk factors)**

## **- Contribution to the development of cardiovascular prevention programs and the measurement of their effectiveness**

# **Parts of Cardiovascular Epidemiology**

## ***1., Descriptive epidemiology:***

## **= Describing distribution of cardiovascular disease by means of certain characteristics such as : PERSON (i.e., age, gender, ethnicity) TIME and PLACE**

## ***2., Analytic epidemiology***

## **= Analyzing relationships between CVD and risk factors (which elevate the probability of a disease at population level).**

## ***3., Experimental epidemiology/Interventions***

## **= Strategies of cardiovascular prevention (primordial, primary, secondary, tertiary; individual and community levels)**

# **Descriptive Epidemiology I. Distribution Patterns in the World**

## **In the world: CVD deaths account for one third of all deaths (25-50% depending on the level of economic development) among which 50%: coronary deaths**

## **CVD made up 16.7 million of global deaths in 2002, among which 7 million due to coronary heart disease, 6 million due to stroke**

## **Global cardiovascular deaths in 2002: 16.7 million**

## **among which: coronary heart disease 7.2 million > stroke 6.0 million > 0.9 million hypertensive heart disease > 0.4 million inflammatory heart disease > 0.3 million rheumatic heart disease > 1.9 million other CVD**

# **Descriptive Epidemiology II. AGE**

## **- Early lesions of blood vessel, atherosclerotic plaques: around 20 years - adult lifestyle patterns usually start in childhood and youth (smoking, dietary habits, sporting behavior, etc.)**

## **- Increase in CVD morbidity and mortality: in age-group of 30-44 years**

## **- Premature death (<64 years of age, or 25-64 years): in the elderly population more difficult to interpret death rate due to multiple ill health causes**

# **Descriptive Epidemiology III. SEX**

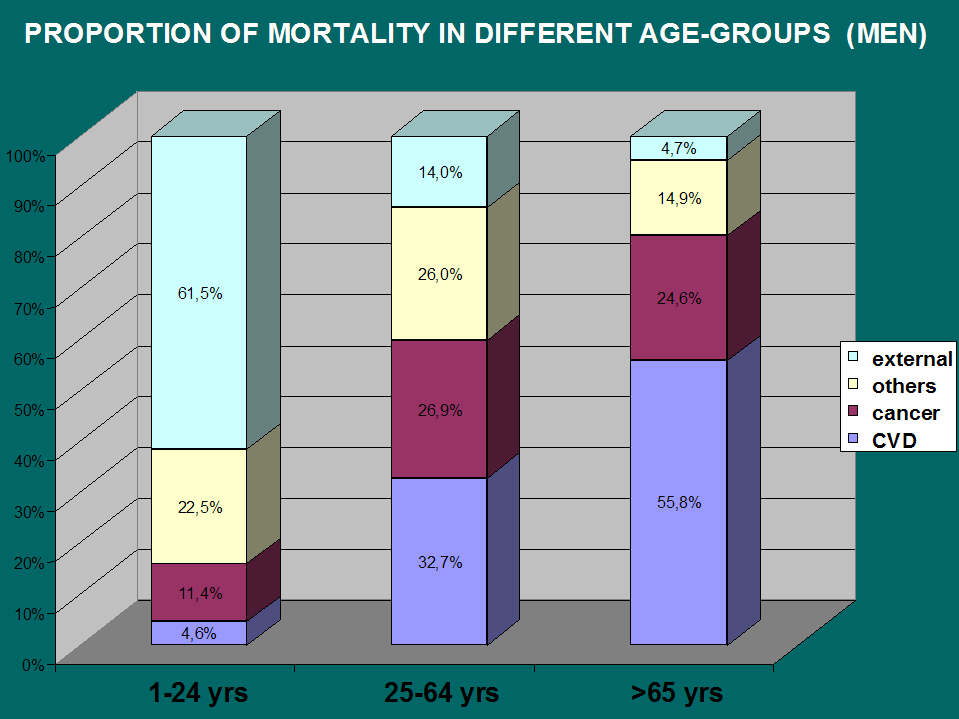
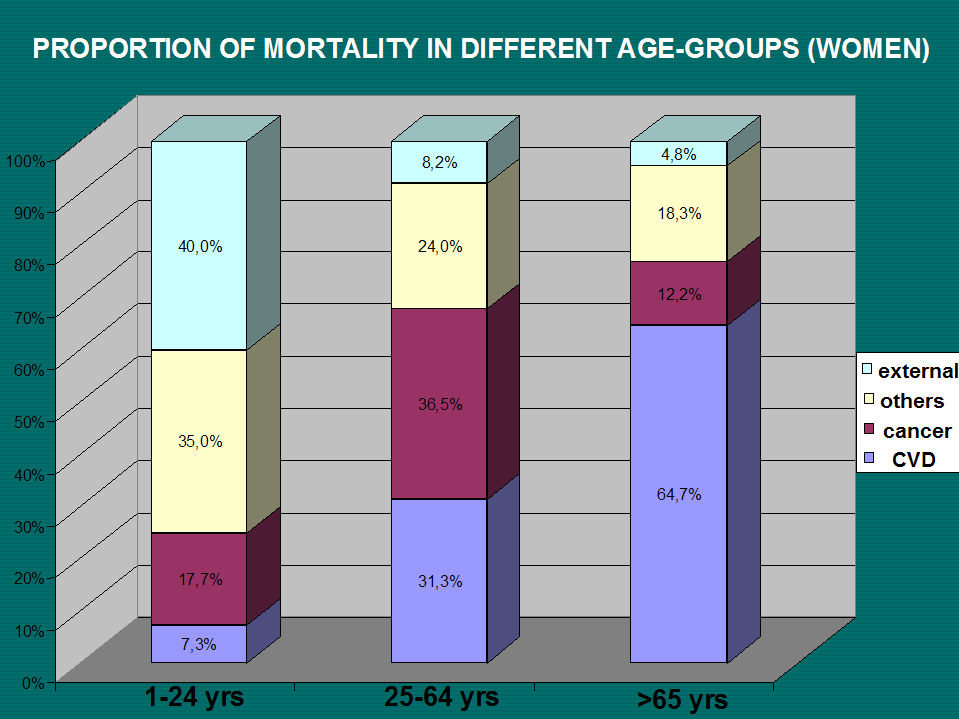
## **CVD affect nearly as many women as men.**

## **- Women: special case (WHO, 2004)**

## **Higher prevalence of certain risk factors in women (diabetes mellitus, high triglyceride levels, depression)**

## **Gender-specific risk factors (risks for women only) (oral contraceptives, hormone replacement therapy, polycystic ovary syndrome)**

# **Descriptive Epidemiology IV. ETHNICITY**



## **Question: What is the relative amount of CVD in death rates in different ethnic groups?**

## **- In the US: increased cardiovascular disease deaths in African-American and South-Asian populations in comparison with Whites**

## **- Increased stroke risk in African-American, some Hispanic American, Chinese, and Japanese populations**

## **- Migration: Ni-Hon-San Study: Japanese living in Japan had the lowest rates of CHD and cholesterol levels, those living in Hawaii had intermediate rates for both, those living in San Francisco had the highest rates for both**

# **Descriptive Epidemiology V. World Trends**

## **Developed countries: decreasing tendencies (e.g, USA: 30% between 1988-98, Sweden: 42%)**

## **improvement of lifestyle factors, for example, a decrease of smoking and a higher level of health consciousness )**

## **- better diagnostic and therapeutic procedures (e.g., bypass surgeries, hypertension screening, pharmacological treatment of hypertension and hypercholesterinaemia, access to health care)**

## **Developing countries: increasing tendencies**

## **- increasing longevity, urbanization, and western type lifestyle**

# **Analytic Epidemiology I. Role of Risk Factors**

## **Over 300 risk factors have been associated with coronary heart disease, hypertension and stroke**

## **Approx. 75% of CVD can be attributed to conventional risk factors**

## **Risk factors of great public health significance:**

## **- high prevalence in many populations**

## **- great independent impact on CVD risk**

## **- their control and treatment result in reduced CVD risk**

## **Developing countries: double burden of risks (problems of undernutrition and infections + CVD risks)**

# **Analytic Epidemiology II. Classification of Risk Factors**

|  |  |
| --- | --- |
| ***Major modifiable risk factors***   * High blood pressure * Abnormal blood lipids * Tobacco use * Physical inactivity * Obesity * Unhealthy diet * Diabetes mellitus | ***Other modifiable risk factors***   * Low socioeconomic status * Mental ill health (depression) * Psychosocial stress * Heavy alcohol use * Use of certain medication |
| ***Non-modifiable risk factors***   * Age * Heredity or family history * Gender * Ethnicity or race | ***”Novel” risk factors***   * Excess homocysteine in blood * Inflammatory markers (C-reactive protein) * Abnormal blood coagulation (elevated blood levels of fibrinogen) |

# **Analytic Epidemiology ---- Abnormal Blood Lipids**

## **- Altering functions of cholesterol fractions (LDL: risk, HDL: protection)**

## **- Estrogen: tends to raise HDL-cholesterol and lower LDL-cholesterol, protection for women in reproductive age**

## **partially dependent of nutrition (egg, meats, dairy products)**

# **Current Recommended Lipid Levels**

|  |  |  |
| --- | --- | --- |
|  | **European guidelines** | **US guidelines** |
| **Total cholesterol** | <5.0 mmol/l | <240 mg/dl (6.2 mmol/l) |
| **LDL-cholesterol** | <3.0 mmol/l | <160 mg/dl (3.8 mmol/l) |
| **HDL-cholesterol** | >=1.0 mmol/l (men)  >=1.2 mmol/l (women) | >=40 mg/dl (1 mmol/l) |
| **Triglycerides (fasting)** | <1.7 mmol/l | <200 mg/dl (2.3 mmol/l) |

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Cholesterol in the blood and tissues is derived from two sources:

diet and endogenous synthesis.

Dairy fat and meat are major dietary sources. Egg yolk is particularly rich in cholesterol but unlike dairy products and meat does not provide saturated fatty acids.

There is no requirement for dietary cholesterol and it is advisable to keep the intake as low as possible. If intake of dairy fat and meat are controlled, there is no need to severely restrict egg yolk intake, although some limitation remains prudent.

***Fatty acids and dietary cholesterol*:**

Dietary intake of fats strongly influences the risk of cardiovascular diseases such as coronary heart disease and stroke, through effects on blood lipids, thrombosis, blood pressure, arterial (endothelial) function, arrythmogenesis and inflammation. However, the qualitative composition of fats in the diet has a significant role to play in modifying this risk.

* **Saturated fatty acids** raise total and low-density lipoprotein (LDL) cholesterol, but individual fatty acids within this group, have different effects *.*
* Myristic and palmitic acids have the greatest effect and are abundant in diets rich in dairy products and meat.
* Stearic acid has not been shown to elevate blood cholesterol and is rapidly converted to oleic acid in vivo.
* The most effective replacement for saturated fatty acids in terms of coronary heart disease outcome are **polyunsaturated fatty acids,** especially linoleic acid. This finding is supported by the results of several large randomized clinical trials, in which replacement of saturated and trans fatty acids by polyunsaturated vegetable oils lowered coronary heart disease risk .
* **Trans fatty acids**: adapt a saturated fatty acid-like configuration. Partial hydrogenation, the process used to increase shelf-life of polyunsaturated fatty acids (PUFAs) creates trans fatty acids . Metabolic studies have demonstrated that trans fatty acids render the plasma lipid profile even more atherogenic than saturated fatty acids, by not only elevating LDL cholesterol to similar levels but also by decreasing highdensity lipoprotein (HDL) cholesterol .
* Several large cohort studies have found that intake of trans fatty acids increases the risk of coronary heart disease . deep-fried fast foods and baked goods are a major and increasing source .

When substituted for saturated fatty acids in metabolic studies, both **monounsaturated fatty acids** and polyunsaturated fatty acids lower plasma total and LDL cholesterol concentrations ; PUFAs are somewhat more effective than monounsaturates in this respect. The only nutritionally important monounsaturated fatty acids is oleic acid, which is abundant in **olive and canola oils** and also **in nuts**. The most important **polyunsaturated fatty** acid is linoleic acid, which is abundant especially in **soybean and sunflower oils**.

***Dietary fibers:***

Dietary fiber is a heterogeneous mixture of polysaccharides and lignin that cannot be degraded by the endogenous enzymes of vertebrate animals. Water-soluble fibres include pectins, gums, mucilages and some hemicelluloses. Insoluble fibres include cellulose and other hemicelluloses. Most fibres reduce plasma total and LDL cholesterol, as reported by several trials . Several large cohort studies carried out in different countries have reported that a high fibre diet as well as a diet high in wholegrain cereals lowers the risk of coronary heart disease .

***Antioxidants, folate, and flavonoids***

Even though antioxidants could, in theory, be protective against CVD and there is observational data supporting this theory, controlled trials employing supplements have been disappointing. The Heart Outcomes Prevention Evaluation trial (HOPE), a definitive clinical trial relating vitamin E supplementation to CVD outcomes, revealed no effect of vitamin E supplementation on myocardial infarction, stroke or death from cardiovascular causes in men or women .

Also, the results of the Heart Protection Study indicated that no significant benefits of daily supplementation of vitamin E, vitamin C and b-carotene were observed among the high-risk individuals that were the subject of the study . In several studies where dietary vitamin C reduced the risk of coronary heart disease, supplemental vitamin C had little effect. Clinical trial evidence is lacking at present. Observational cohort studies have suggested a protective role for carotenoids but a meta-analysis of four randomized trials, in contrast, reported an increased risk of cardiovascular death .

The relationship of folate to CVD has been mostly explored through its effect on homocysteine, which may itself be an independent risk factor for coronary heart disease and probably also for stroke. Folic acid is required for the methylation of homocysteine to methionine. Reduced plasma folate has been strongly associated with elevated plasma homocysteine levels and folate supplementation has been demonstrated to decrease those levels . However, the role of homocysteine as an independent risk factor for CVD has been subject to much debate, since several prospective studies have not found this association to be independent of other risk factors . It has also been suggested that elevation of plasma homocysteine is a consequence and not a cause of atherosclerosis, wherein impaired renal function resulting from atherosclerosis raises plasma homocysteine levels .

Data from the Nurses’ Health Study showed that folate and vitamin B6, from diet and supplements, conferred protection against coronary heart disease . A recently published metaanalysis concluded that a higher intake of folate (0.8 mg folic acid) would reduce the risk of ischaemic heart disease by 16% and stroke by 24% .

Flavonoids are polyphenolic compounds that occur in a variety of foods of vegetable origin, such as tea, onions and apples. Data from several prospective studies indicate an inverse association of dietary flavonoids with coronary heart disease . However, confounding may be a major problem and may explain the conflicting results of observational studies.

***Sodium and potassium***

High blood pressure is a major risk factor for coronary heart disease and both forms of stroke (ischaemic and haemorrhagic). Of the many risk factors associated with high blood pressure, the dietary exposure that has been most investigated is daily sodium intake. It has been studied extensively in animal experimental models, in epidemiological studies, controlled clinical trials and in population studies on restricted sodium intake *.*

All these data show convincingly that sodium intake is directly associated with blood pressure. An overview of observational data obtained from population studies suggested that a difference in sodium intake of 100 mmol per day was associated with average differences in systolic blood pressure of 5 mmHg at age 15-19 years and 10 mmHg at age 60-69 years *.* Diastolic blood pressures are reduced by about half as much, but the association increases with age and magnitude of the initial blood pressure.

It was estimated that a universal reduction in dietary intake of sodium by 50 mmol per day would lead to a 50% reduction in the number of people requiring antihypertensive therapy, a 22% reduction in the number of deaths resulting from strokes and a 16%reduction in the number of deaths from coronary heart disease.

The first prospective study using 24-hour urine collections for measuring sodium intake, which is the only reliable measure, demonstrated a positive relationship between an increased risk of acute coronary events, but not stroke events, and increased sodium excretion. The association was strongest among overweight men.

Several clinical intervention trials, conducted to evaluate the effects of dietary salt reduction on blood pressure levels, have been systematically reviewed. Based on an overview of 32 methodologically adequate trials, Cutler, Follmann & Allender *(39)* concluded that a daily reduction of sodium intake by 70-80 mmol was associated with a lowering of blood pressure both in hypertensive and normotensive individuals, with systolic and diastolic blood pressure reductions of 4.8/1.9 mmHg in the former and 2.5/1.1 mmHg in the latter.

Clinical trials have also demonstrated the sustainable blood pressure lowering effects of sodium restriction in infancy *(41, 42)*, as well as in the elderly in whom it provides a useful nonpharmacological therapy *(43)*. The results of a low-sodium diet trial *(44)* showed that low-sodium diets, with 24-hour sodium excretion levels around 70 mmol, are effective and safe. Two population studies, in China and in Portugal, have also revealed significant reductions in blood pressure in the intervention groups *(45, 46)*.

A meta-analysis of randomized controlled trials showed that potassium supplements reduced mean blood pressures (systolic/diastolic) by 1.8/1.0 mmHg in normotensive subjects and 4.4/2.5 mmHg in hypertensive subjects *(47)*. Several large cohort studies have found an inverse association between potassium intake and risk of stroke *.* While potassium supplements have been shown to have protective effects on blood pressure and cardiovascular diseases, there is no evidence to suggest that long-term potassium supplements should be administered to reduce the risk for CVD. The recommended levels of fruit and vegetable consumption assure an adequate intake of potassium.

***Food items and food groups***

1. **Fruits and vegetables:**

While the consumption of fruits and vegetables has been widely believed to promote good health, evidence related to their protective effect against CVD has only been presented in recent years *.* Numerous ecological and prospective studies have reported a significant protective association for coronary heart disease and stroke with consumption of fruits and vegetables *.* The effects of increased fruit and vegetable consumption on blood pressure alone and in combination with a low-fat diet, were assessed in the Dietary Approaches to Stop Hypertension (DASH) trial *.*While the combination diet was more effective in lowering blood pressure, the fruit and vegetable diet also lowered blood pressure (by 2.8 mmHg systolic and 1.1 mmHg diastolic) in comparison to the control diet. Such reductions, while seeming modest at the individual level, would result in a substantial reduction in population-wide risk of CVD by shifting the blood pressure distribution.

1. **Fish:**

Most, but not all, population studies have shown that fish consumption is associated with a reduced risk of coronary heart disease. A systematic review concluded that the discrepancy in the findings may be a result of differences in the populations studied, with only high-risk individuals benefiting from increasing their fish consumption *.*It was estimated that in high-risk populations, an optimum fish consumption of 40-60 g per day would lead to approximately a 50% reduction in death from coronary heart disease.

A recent study based on data from 36 countries, reported that fish consumption (at least twice a week ) is associated with a reduced risk of death from all causes as well as CVD mortality *.*

1. **Nuts:**

Several large epidemiological studies have demonstrated that frequent consumption of nuts was associated with decreased risk of coronary heart disease *.*Most of these studies considered nuts as a group, combining many different types of nuts. Nuts are high in unsaturated fatty acids and low in saturated fats, and contribute to cholesterol lowering by altering the fatty acid profile of the diet as a whole. However, because of the high energy content of nuts, advice to include them in the diet must be tempered in accordance with the desired energy balance.

1. **Soy**:

Several trials indicate that soy has a beneficial effect on plasma lipids *.* A composite analysis of 38 clinical trials found that an average consumption of 47 g of soy protein a day led to a 9% decline in total cholesterol and a 13% decline in LDL cholesterol in subjects free of coronary heart disease. Soy is rich in isoflavones, compounds that are structurally and functionally similar to estrogen. Several animal experiments suggest that the intake of these isoflavones may provide protection against coronary heart disease, but human data on efficacy and safety are still awaited.

1. **Coffee:**

Boiled, unfiltered coffee raises total and LDL cholesterol because coffee beans contain a terpenoid lipid called cafestol. The amount of cafestol in the cup depends on the brewing method: it is zero for paper-filtered drip coffee, and high in the unfiltered coffee still widely drunk in, for example, in Greece, the Middle East and Turkey. Intake of large amounts of unfiltered coffee markedly raises serum cholesterol and has been associated with coronary heart disease in Norway . A shift from unfiltered, boiled coffee to filtered coffee has contributed significantly to the decline in serum cholesterol in Finland .

**Dietary recommendations to protect against CVD:**

**1-fat:**

The evidence shows that intake of saturated fatty acids is directly related to cardiovascular risk. The traditional target is to restrict the intake of saturated fatty acids to less than 10%, of daily energy intake and less than 7% for high-risk groups.

Within these limits, intake of foods rich in myristic and palmitic acids should be replaced by fats with a lower content of these particular fatty acids. In developing countries, however, where energy intake for some population groups may be inadequate, energy expenditure is high and body fat stores are low (BMI <18.5 kg/m2). The amount and quality of fat supply has to be considered keeping in mind the need to meet energy requirements. Specific sources of saturated fat, such as coconut and palm oil, provide low-cost energy and may be an important source of energy for the poor.

Not all saturated fats have similar metabolic effects; those with 12-16 carbons in the fatty acid chain have a greater effect on raising LDL cholesterol. This implies that the fatty acid composition of the fat source should be examined. As populations progress in the nutrition transition and energy excess becomes a potential problem, restricting certain fatty acids becomes progressively more relevant to ensuring cardiovascular health.

To promote cardiovascular health, diets should provide a very low intake of trans fatty acids (hydrogenated oils and fats). In practice, this implies an intake of less than 1% of daily energy intake. This recommendation is especially relevant in developing countries where low-cost hydrogenated fat is frequently consumed. The potential effect of human consumption of hydrogenated oils of unknown physiological effects (e.g. marine oils) is of great concern.

Diets should provide an adequate intake of PUFAs, i.e. in the range 6-10% of daily energy intake. There should also be an optimal balance between intake of n-6 PUFAs and n-3 PUFAs, i.e. 5-8% and 1-2% of daily energy intake, respectively.

Intake of oleic acid, a monounsaturated fatty acid, should make up the rest of the daily energy intake from fats, to give a daily total fat intake ranging from15%up to30%of daily energy intake. Recommendations for total fat intake may be based on current levels of population consumption in different regions and modified to take account of age, activity and ideal body weight. Where obesity is prevalent, for example, an intake in the lower part of the range is preferable in order to achieve a lower energy intake. While there is no evidence to directly link the quantity of daily fat intake to an increased risk of CVD, total fat consumption should be limited to enable the goals of reduced intake of saturated and trans fatty acids to be met easily in most populations and to avoid the potential problems of undesirable weight gain that may arise from unrestricted fat intake. It should be noted that highly active groups with diets rich in vegetables, legumes, fruits and wholegrain cereals will limit the risk of unhealthy weight gain on a diet comprising a total fat intake of up to 35%.

These dietary goals can be met by limiting the intake of fat from dairy and meat sources, avoiding the use of hydrogenated oils and fats in cooking and manufacture of food products, using appropriate edible vegetable oils in small amounts, and ensuring a regular intake of fish (one to two times per week) or plant sources of a-linolenic acid. Preference should be given to food preparation practices that employ non-frying methods.

**2- Fruits and vegetables**

Fruits and vegetables contribute to cardiovascular health through the variety of phytonutrients, potassium and fibre that they contain. Daily intake of fresh fruit and vegetables (including berries, green leafy and cruciferous vegetables and legumes), in an adequate quantity (400-500 g per day), is recommended to reduce the risk of coronary heart disease, stroke and high blood pressure.

**3- Sodium**

Dietary intake of sodium, from all sources, influences blood pressure levels in populations and should be limited so as to reduce the risk of coronary heart disease and both forms of stroke. Current evidence suggests that an intake of no more than 70 mmol or 1.7 g of sodium per day is beneficial in reducing blood pressure. The special situation of individuals (i.e. pregnant women and non-acclimated people who perform strenuous physical activity in hot environments) who may be adversely affected by sodium reduction needs to be kept in mind.

Limitation of dietary sodium intake to meet these goals should be achieved by restricting daily salt (sodium chloride) intake to less than 5 g per day. This should take into account total sodium intake from all dietary sources, for example additives such as monosodium glutamate and preservatives. Use of potassium-enriched low-sodium substitutes is one way to reduce sodium intake. The need to adjust salt iodization, depending on observed sodium intake and surveillance of iodine status of the population, should be recognized.

**4- Potassium**

Adequate dietary intake of potassium lowers blood pressure and is protective against stroke and cardiac arrythmias. Potassium intake should be at a level which will keep the sodium to potassium ratio close to 1.0, i.e. a daily potassium intake level of 70-80 mmol per day. This may be achieved through adequate daily consumption of fruits and vegetables.

**5- dietary fiber**

Fibre is protective against coronary heart disease and has also been used in diets to lower blood pressure. Adequate intake may be achieved through fruits, vegetables and wholegrain cereals.

**6- Fish**

Regular fish consumption (1-2 servings per week) is protective against coronary heart disease and ischaemic stroke and is recommended. The serving should provide an equivalent of 200-500 mg of eicosapentaenoic and docosahexaenoic acid. People who are vegetarians are recommended to ensure adequate intake of plant sources of a-linolenic acid.

**Summary of strength of evidence on lifestyle factors and risk of developing cardiovascular diseases**

|  |  |  |  |
| --- | --- | --- | --- |
| **Evidence** | **Decreased risk** | **No relationship** | **Increased risk** |
| **Convincing** | Regular physical activity Linoleic acid Fish and fish oils  Vegetables and fruits (including berries) Potassium | Vitamin E supplements | Myristic and palmitic acids Trans fatty acids High sodium intake Overweight High alcohol intake (for stroke) |
| **Probable** | a-Linolenic acid Oleic acid NSP Wholegrain cereals Nuts (unsalted) Plant sterols/stanols Folate | Stearic acid | Dietary cholesterol Unfiltered boiled coffee |
| **Possible** | Flavonoids Soy products |  | Fats rich in lauric acid Impaired fetal nutrition Beta-carotene supplements |
| **Inufficient** | Calcium Magnesium Vitamin C |  | Carbohydrates Iron |

# **Analytic Epidemiology VI. Tobacco Use**

## **- The link between smoking and CVD (mainly CHD) was identified in 1940**

## **- Greatest risk: initiation < 16 years**

## **- Passive smoking: additional risk**

## **- Women smokers: are at higher risk of CHD and CVD than male smokers**

## **- Several mechanisms: damages the endothelium lining, increases atherosclerotic plaques, raises LDL and lowers HDL, promotes artery spasms, raises oxigen demand of the heart muscle**

## **- Nicotine accelerates the heart rate (RR), and raises blood pressure**

# **Analytic Epidemiology VII. Physical Inactivity**

## **- Regular physical activity: protective factor**

## **- Intensity and duration (150 minutes/week intermediate or 60 minutes/week heavy)**

## **- Modernization, urbanization, mechanized transport: sedentary lifestyle (60% of global population)**

## **- Raises CVD risk and also the development of other risk factors (glucose metabolism, diabetes mellitus, blood coagulation, obesity, high blood pressure, worsening lipid profile)**

## **- Physical activity: helps reduce stress, anxiety and depression**

# **Analytic Epidemiology VIII. Obesity, Diabetes Mellitus, Unhealthy Diet**

## **- Body Mass Index: > 25: overweight, > 30: obesity**

## **- A modern ”epidemic”: More than 60% of adults in the US are overweight or obese, in China: 70 million overweight people**

## **- Elevates the risk of both CVD and diabetes mellitus**

## **- Diabetes mellitus: damages both peripheral and coronary blood vessels**

## **-Unhealthy diet: low fruit and vegetable, fiber content, and high saturated fat intake, refined sugar**

# **Analytic Epidemiology IX. Psychological and social factors**

## **- Psychological factors (Type A behavior, hostility)**

## **- Depression and CVD: bidirectional link**

## **a., depression may increase the risk of CVD and worsen recovery process**

## **b., CVD may induce depression**

## **- Low socioeconomic status (SES):**

## **a., in developed countries: less educated and lower SES groups (accumulation of risk factors)**

## **b., in developing countries: more educated and higher SES groups (western lifestyle)**

# **Cardiovascular Prevention I.**

## ***Primordial*:**

## ***Prevents the occurance of isk factors*: Social, legal and other (often nonmedical) activities which may lead to a lowering of risk factors (e.g., socioeconomic development, smoke-free restaurants)**

## ***Primary:* Controlling risk factors contributing to CVD (health education programs, anti-smoking campaign, sports programs, nutrition counselling, regular check of blood pressure and certain blood parameters, e.g., cholesterol, blood lipids, glucose)**

## ***Secondary*: Screening and treatment of symptomatic patients, set up personal risk profile**

## ***Tertiary:* Cardiovascular rehabilitation, prevention of recurrence of CVD (new heart attack: 5-7 times higher risk among CVD patients)**