MUNI
MED

Health, disease, normality and the factros of healthy lifestyle

Health

x

Disease

Healthe

No - disease

X

Disease

No - health

Disease - illness – symptom - syndrom

- Disease – objectively detectabel
- Illness – subjectively felt

- Sign – objective „issue“ (swelling)
- Symptom – subjective „issue“ (pain)

- Syndrome – typical cluster of signs and symptomes
- Disease
  - Asymptomatic (disease without illness/signs without symptoms)
  - Symptomatic (disease with illnes)

Health

Health is a state of **complete physical, mental and social well-being and not merely the absence of disease or infirmity.**

(WHO, 1946).

Health

Health is a state of **complete physical, mental and social well-being and not merely the absence of disease or infirmity.**

(WHO, 1946).

- ✓ Physiological component – objective
- ✓ Psychological component – subjective
- ➢ Synthesis of neutral and normative concepts

Neutral and normative concepts of health/disease

- Neutral concept
  - Objective (disease)
  - Health – normal function
  - Disease – impaired function
- Normative concept
  - Subjective (illness)
  - Health – ability to achieve desired goals
  - Disease/Illness – limitations causing inability to chieve desired goals

What is normal in medecine?

- Usual – NO
- Functional – YES

- Normality may be considered from medical point of view as health

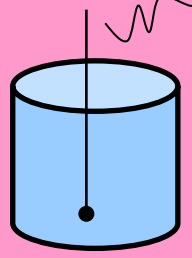
Quantitative

Qualitative

- When trying to quantify, we run into the trouble with data variability

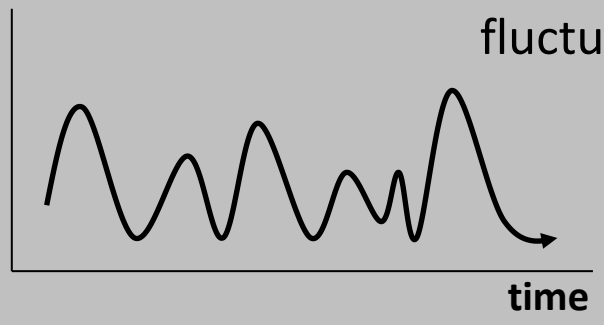
Intra and interindividual variability

repeated measurements
of temperature
18.2°C
18.5°C
19.1°C
18.7°C

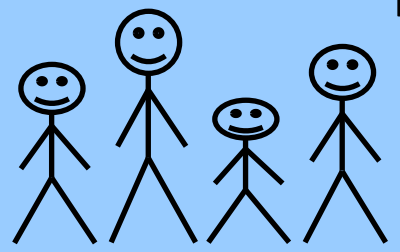


diversity in biological
populations
inter-population or ethnical
differences
= BIODIVERZITY

temporal changes/
fluctuations



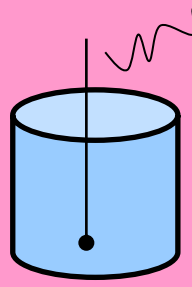
variability of height
in population



180 cm
175 cm
165 cm
157 cm

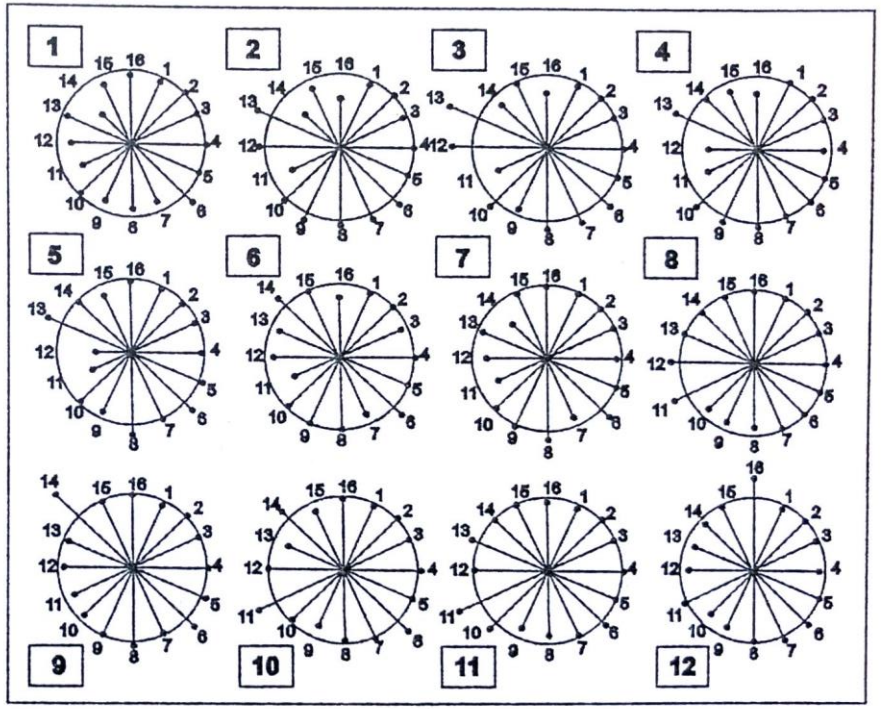
Intra and interindividual variability

repeated measurements of temperature

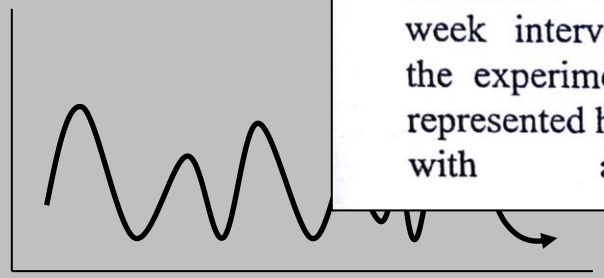


diversity in biological populations
population or ethnical differences
= BIODIVERZITY

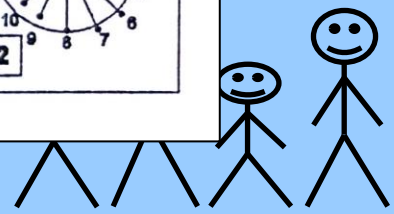
Fig. 1 **"Profiles" of organ functions in healthy persons.** 16 physiological features (blood pressure, heart rate, urinary excretion, creatinine clearance, osmotic clearance, urinary pH, resting and exercising pulmonary ventilation, etc.) were measured in 12 healthy men for 6 successive weeks in one-week intervals. Mean of the experimental group is represented here by a circle with a radius



Vácha J.: Health, Disease, Normality; Brno; LFMU; 2004

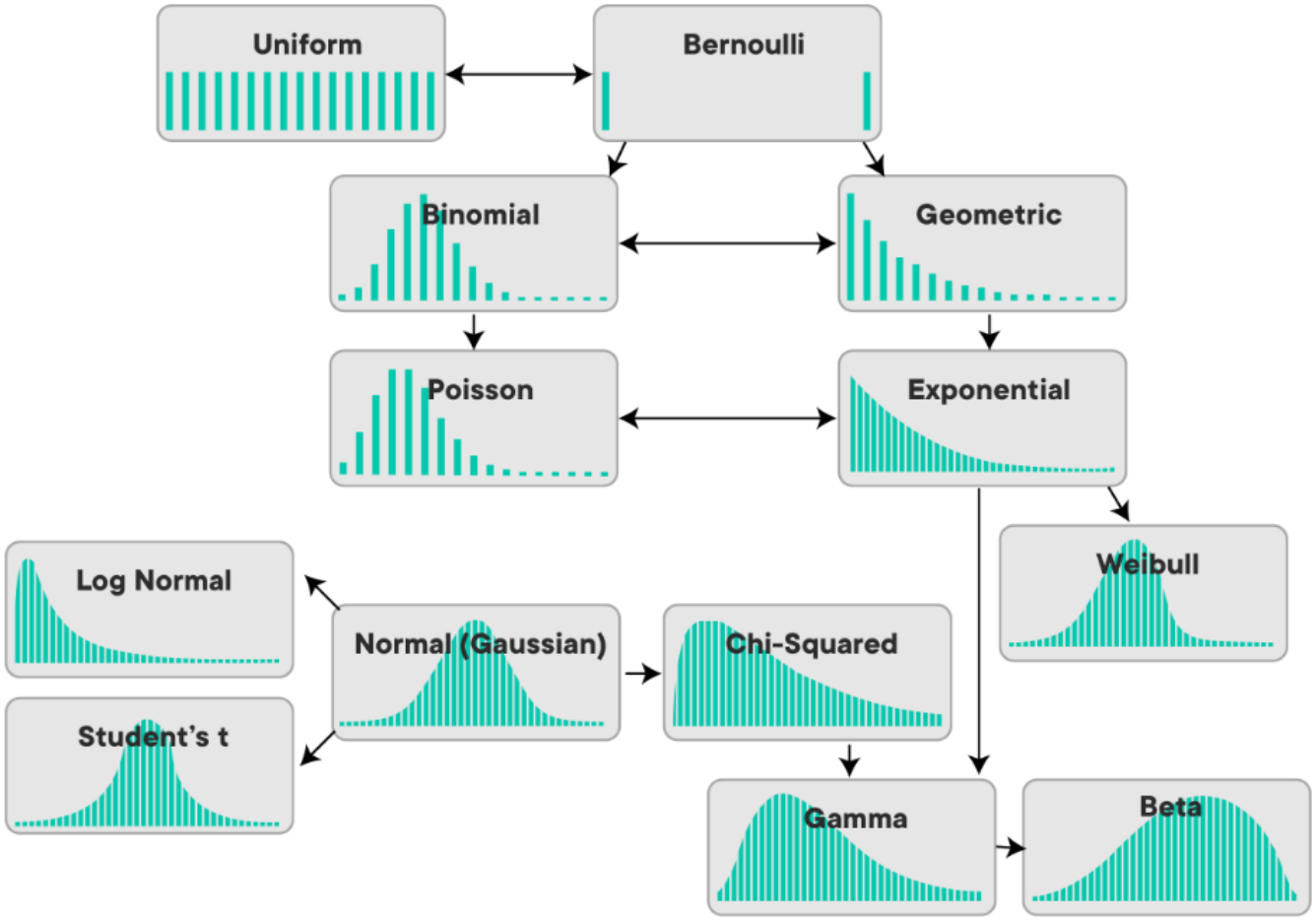


variability of height in population



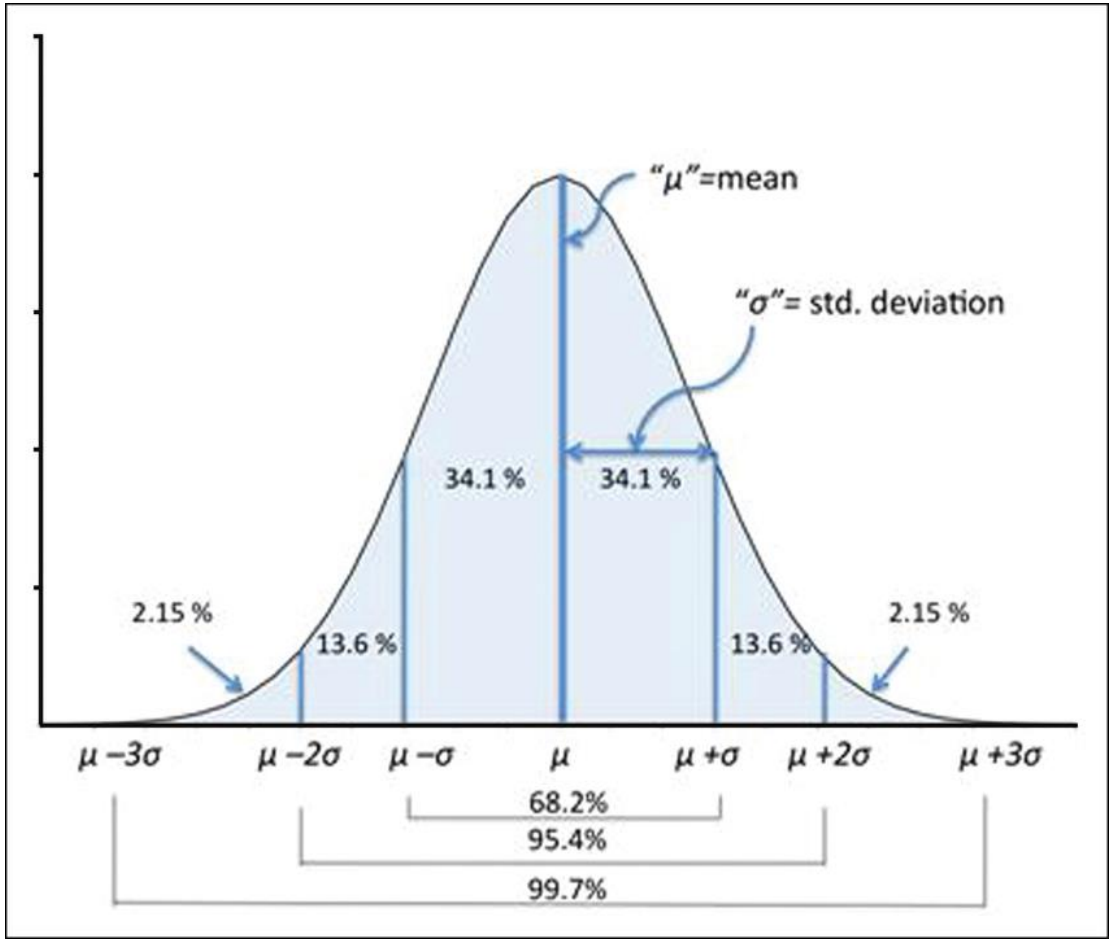
180 cm
175 cm
165 cm
157 cm

Data distribution



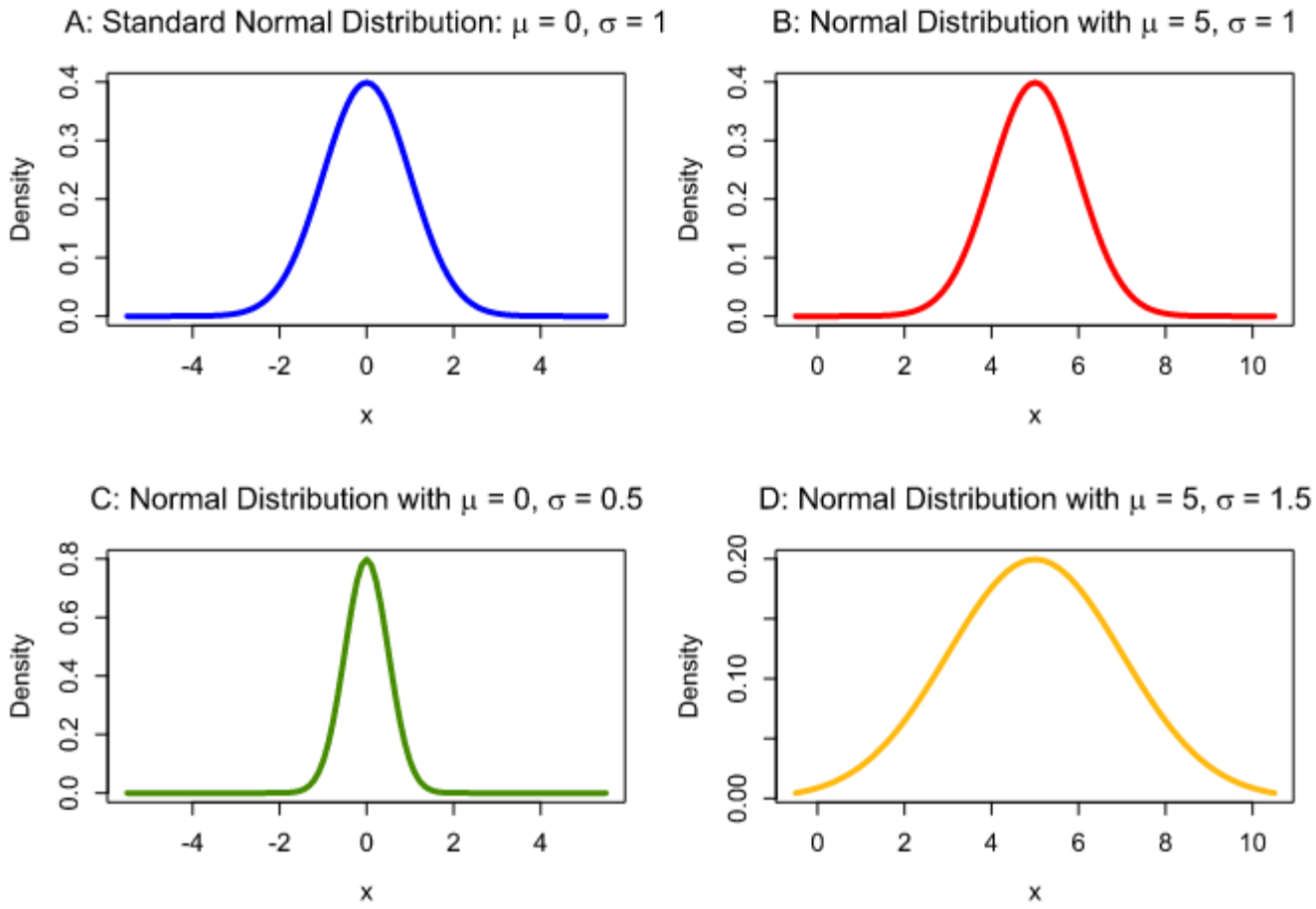
https://medium.com/mytake/understanding-different-types-of-distributions-you-will-encounter-as-a-data-scientist-27ea4c375eec

Normal data distribution



https://www.researchgate.net/figure/Illustration-of-the-normal-distribution-mean-standard-deviation_fig1_47300259

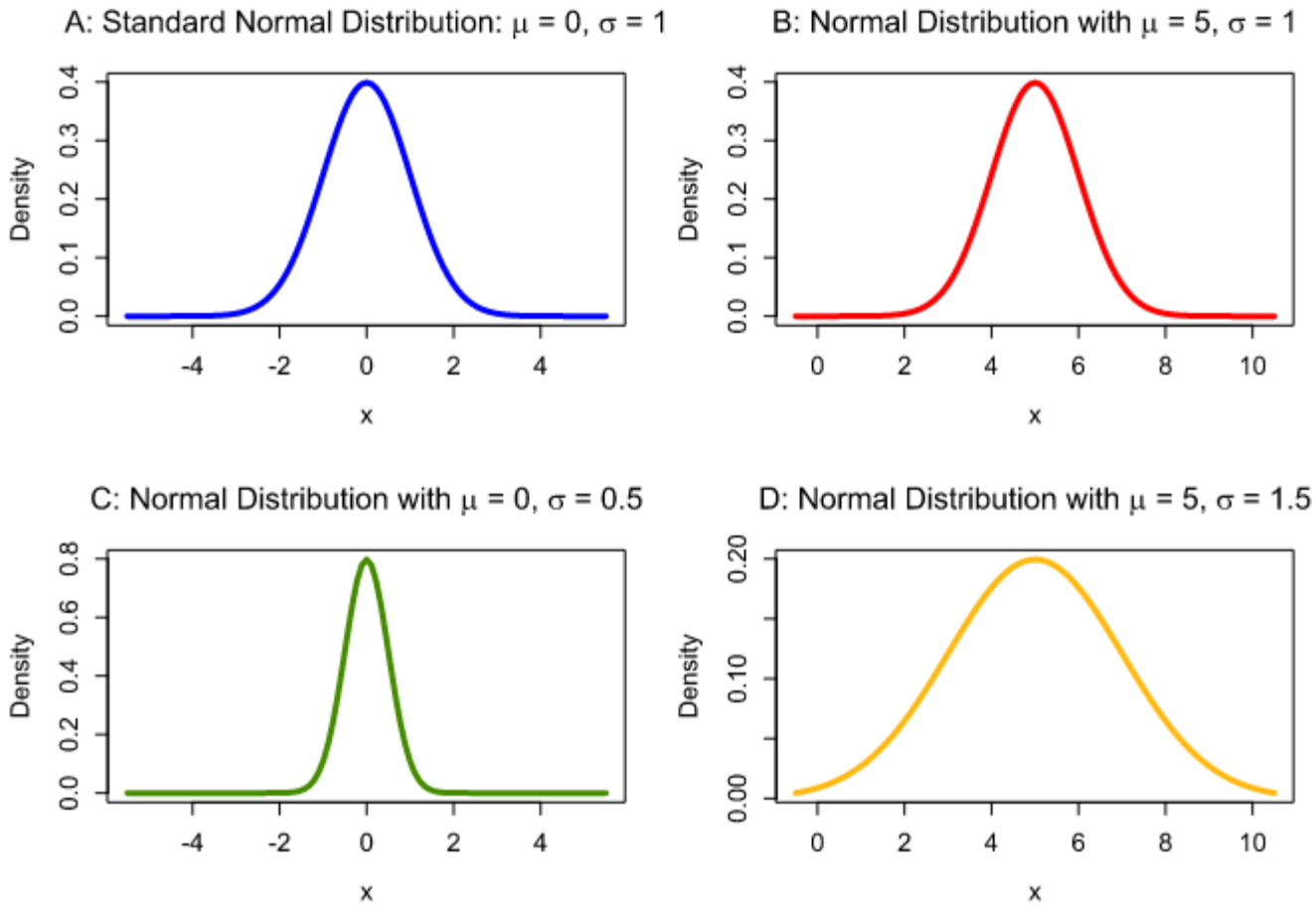
Normal data distribution



https://bookdown.org/a_shaker/STM1001_Topic_3/4-the-normal-distribution.html

Normal data distribution

How to distinguish between usual and functional?



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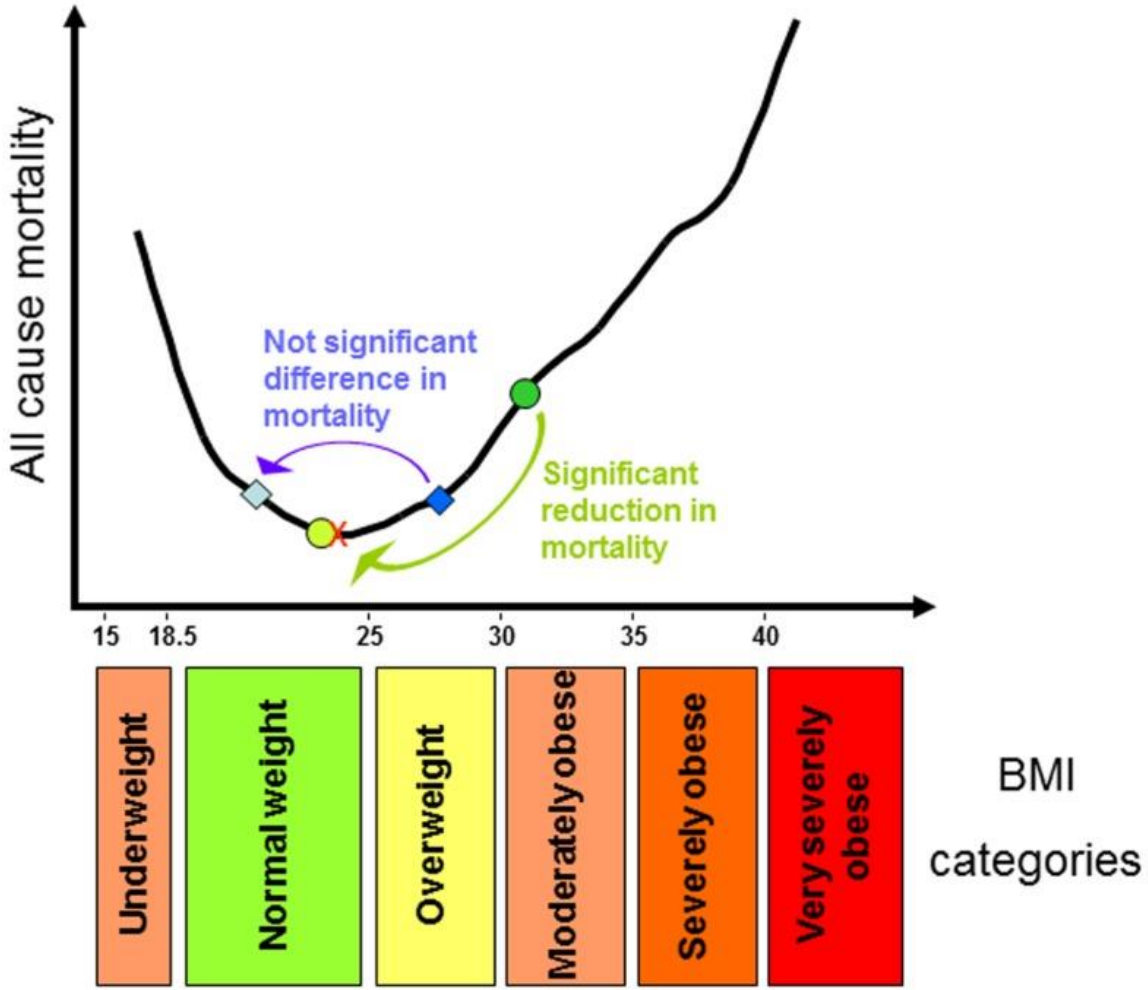
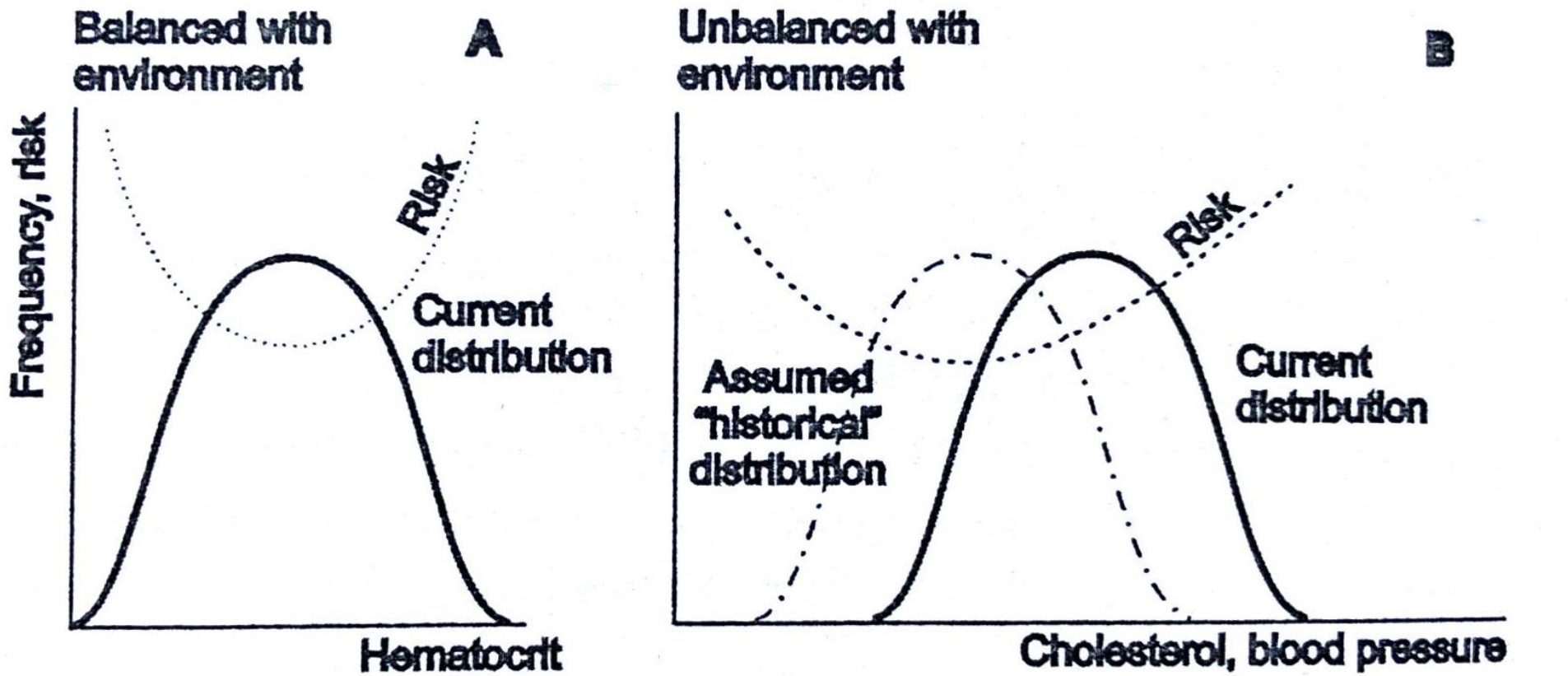


How Much Should We Weigh for a Long and Healthy Life Span? The Need to Reconcile Caloric Restriction versus Longevity with Body Mass Index versus Mortality Data - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/U-shaped-curve-showing-the-relationship-between-all-cause-mortality-and-body-mass-index_fig1_264794803 [accessed 1 Oct, 2022]



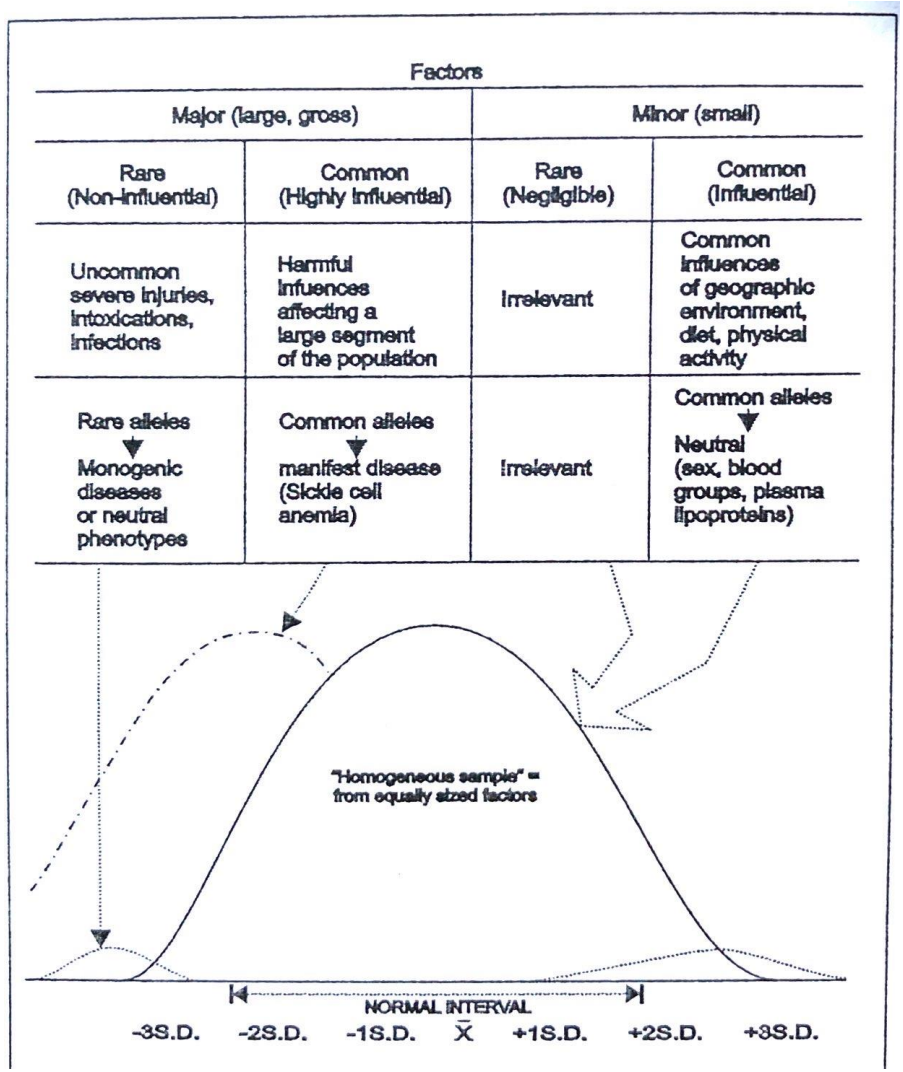
Vácha J.: Health, Disease, Normality; Brno; LFMU; 2004

Factors influencing the disease development

Internal x Extrenal

Major x Minor

Common x Rare



Modifiable x Unmodifiable

Vácha J.: Health, Disease, Normality; Brno; LFMU; 2004

Healthe and disease models

- **Alternative model**
  - The all or nothing principle
  - Influence of major factor / heterogenous set of causes
  - Focus of curative medecine

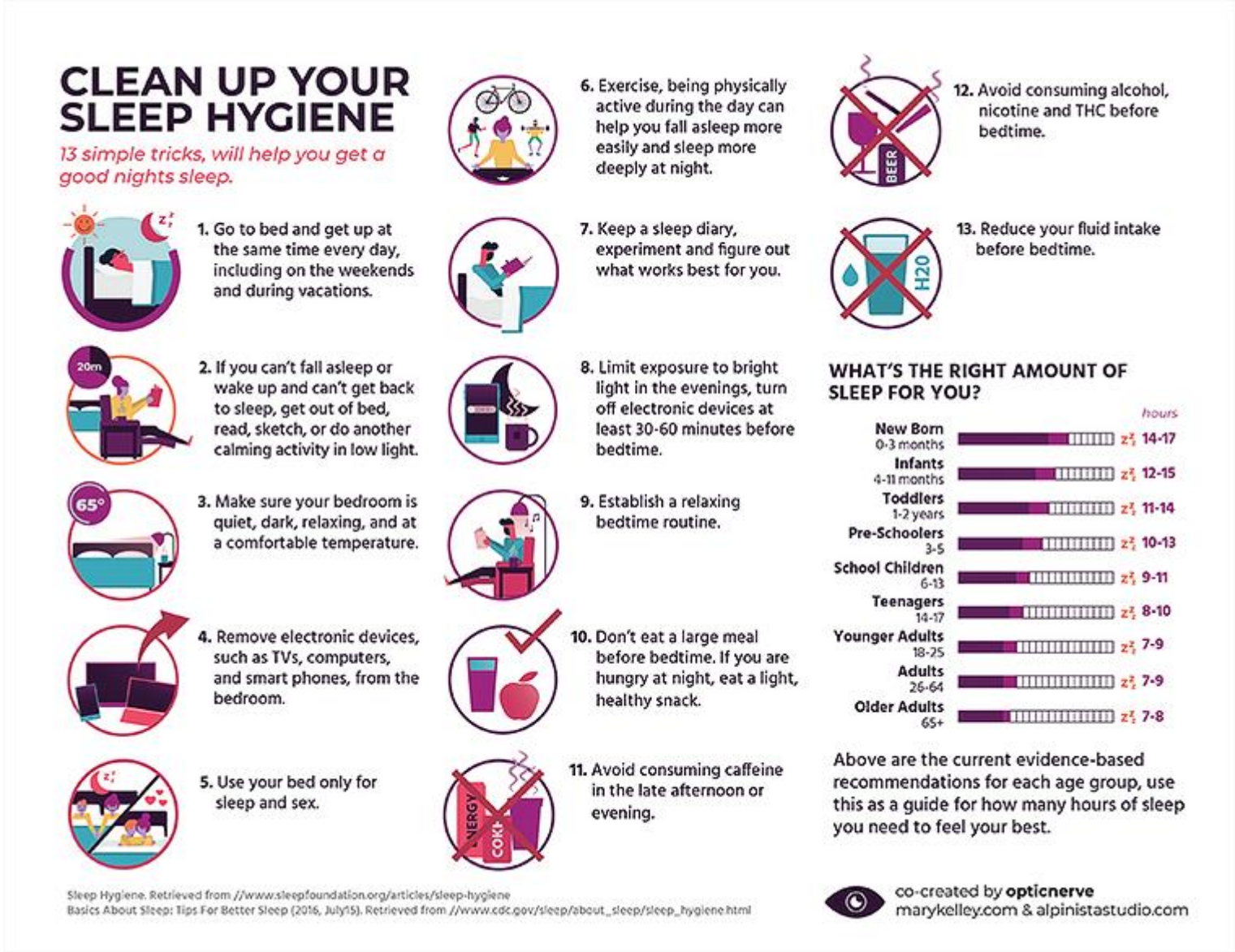
- **Continuous (graded) model**
  - Continuous transition between health and disease
  - Influence of numerous minor factors / homogenous set of causes
  - Focuse of preventive medecine

Factors of a healthy lifestyle

- The principle of moderation
  - Risk diversification
  - We don't have all the information and what seems healthy today may viewed differently in the light of new knowledge in the future

- Nutrition
- Physical aktivity
- Sleep

Sleep



- Sleep hygiene is the most underrated factor in a healthy lifestyle (perhaps because it has limited marketing potential)
- The need for sleep is individual, but in general we can say that we sleep less than we should

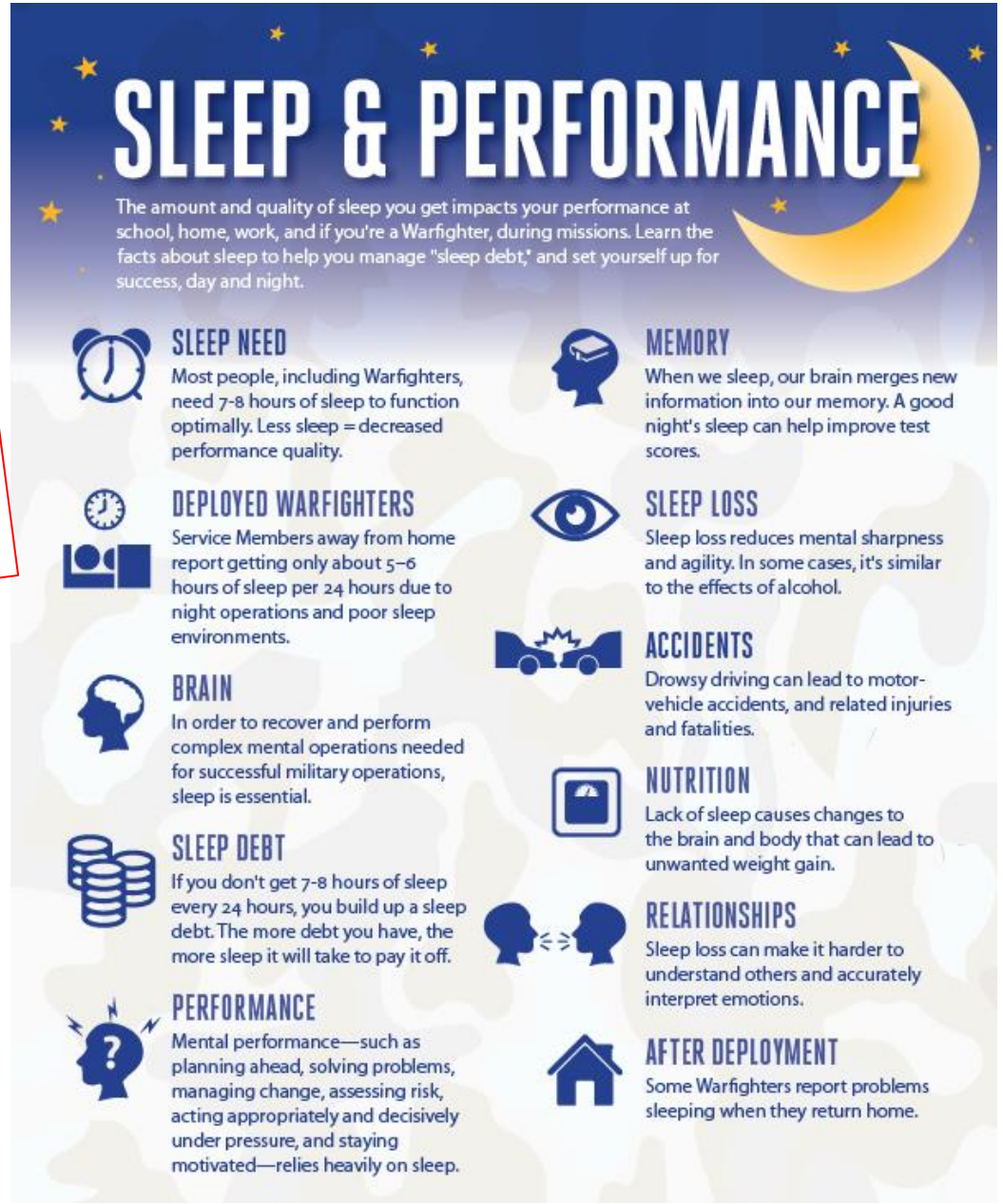
https://neuropathycommons.org/neuropathy/neuropathy-sleep/sleep-hygiene

Risks associated with chronic sleep deprivation

- Cardiovascular systém
  - Mainly hypertension
- Immunity
  - ✓ Increased susceptibility to infections
- Metabolism
  - ✓ Higher risk of obesity, metabolic syndrome and DM
    - ➢ Slowing down of metabolism
    - ➢ ↓Leptin ↑Gherilin
    - ➢ ↓ insulin sensitivity and glucose tolerance
- Brain
  - ✓ Decreased cognitive performance and concentration
  - ✓ Reduced spontaneity – reduced physical activity
  - ✓ Increased appetite for calorically dense, sweet and fatty food (according to one theory, the brain interprets fatigue as a lack of energy)

✓ **Sleep deprivation is one of the most powerful stressors**

✓ **The risks correspond to the risks associated with chronic stress**



https://www.hprc-online.org/mental-fitness/sleep-stress/learn-how-sleep-impacts-your-performance

Chronic fatigue syndrome

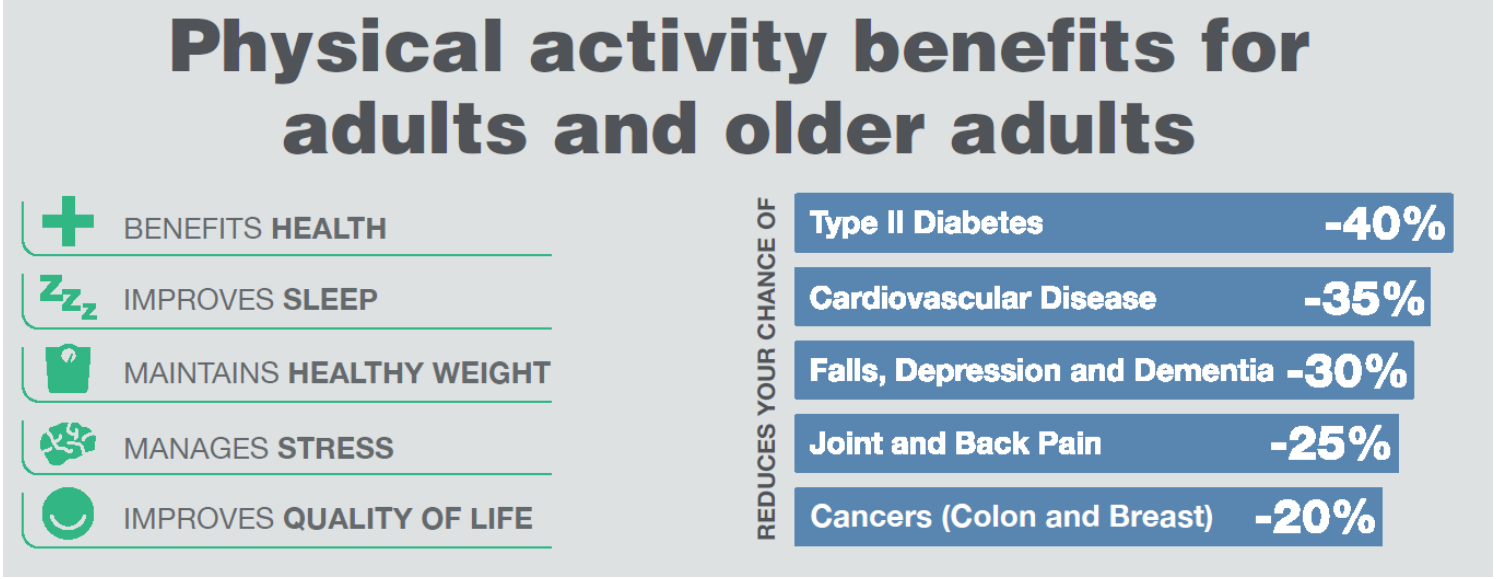
- Sleep deprivation is NOT chronic fatigue syndrome
- Sleep eliminates sleep deprivation, but sleep cannot improve CFS
- CFS is a complex disease of unclear etiology that manifests by
  - ✓ Reduced performance
  - ✓ Load intolerance
  - ✓ Sleep disorders
  - ✓ Cognitive disorders with preserved intellect
- Etiology is not clear and is probably multifactorial
  - ✓ Past infection (most commonly reported cause)
  - ✓ Immune systém impairment
  - ✓ Endocrine disorders
  - ✓ Neurological/psychological disorders (especially emotional stress)
- Sleep deprivation causes/worsens the course of the above-mentioned etiological factors
- Thus, sleep deprivation is an indirect risk factor for CFS

https://www.hprc-online.org/mental-fitness/sleep-stress/learn-how-sleep-impacts-your-performance

Benefits of physical activity according to WHO

Physical activity

- Reduces the risk of civilization diseases, especially cardiovascular diseases, tumors, DM
- Improves the psychological state, in particular it has a beneficial effect on depression, anxiety and a general feeling of well-being
- Improves cognitive functions: thinking, learning, judgmentIt
- Ensures healthy development in childhood and youth
- Globally, 25% of the adult population does not perform the minimum recommended physical activity
- Up to 5 million deaths per year could be delayed worldwide by increased physical activity
- Insufficiently active individuals have a 20-30% higher risk of death than active individuals
- Globally, more than 80% of youth have insufficient physical activity



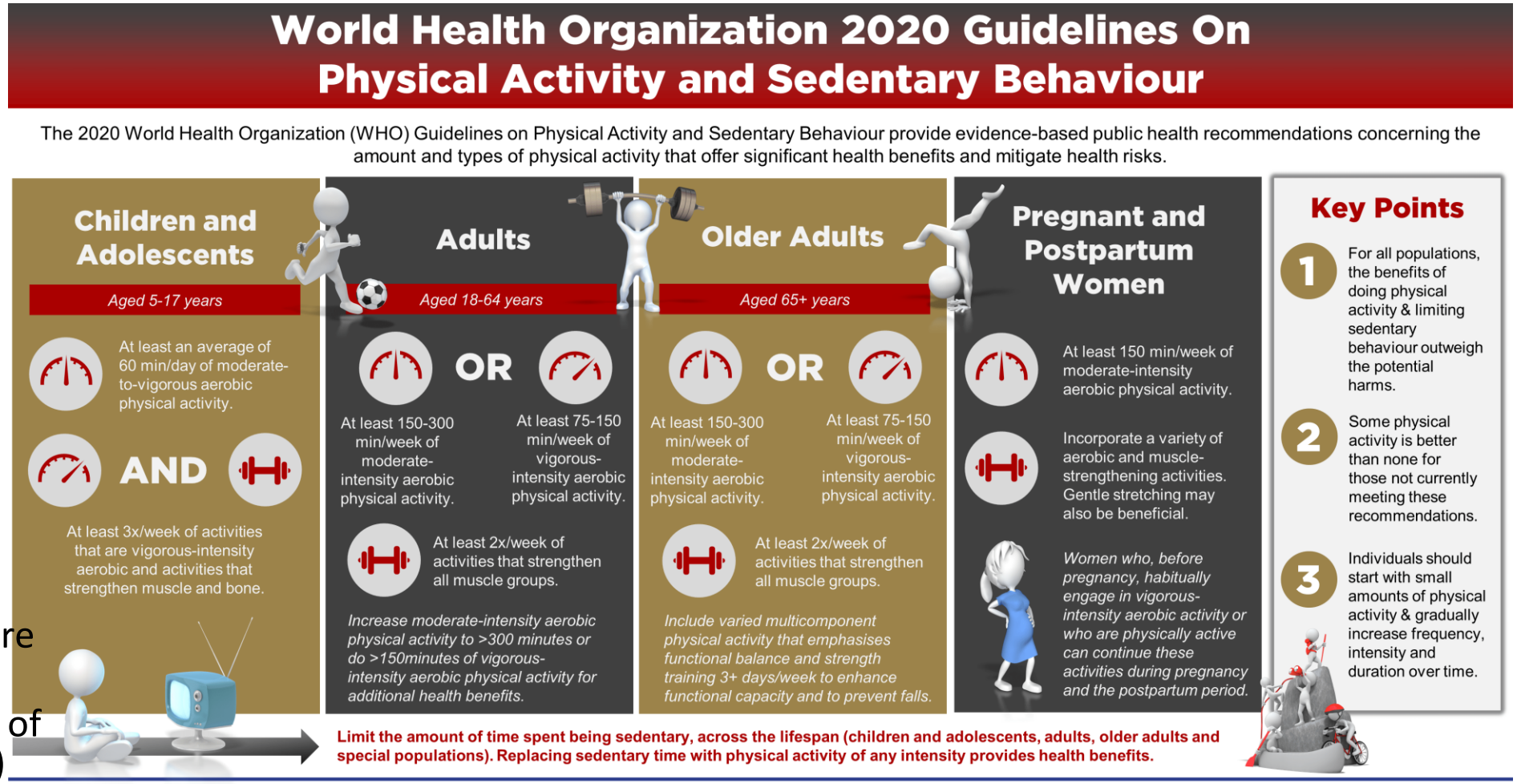
https://www.gov.uk/government/publications/physical-activity-guidelines-infographics

Physical activity

- **Recommended**
  - ✓ Aerobic activity
  - ✓ Strength training
  - ✓ (Balance exercise 65+)
- **Beneficial effect**
  - ✓ Body weight
  - ✓ Cardiovascular system
  - ✓ Muscles
  - ✓ Bones
  - ✓ Joints

➢ Weight-bearing activities are preferredKomplexní

  - ✓ Complex (involvement of several muscle groups)
  - ✓ Prevention of osteoporosis



https://adamvirgile.com/2021/01/19/world-health-organization-2020-guidelines-n-physical-activity-and-sedentary-behaviour

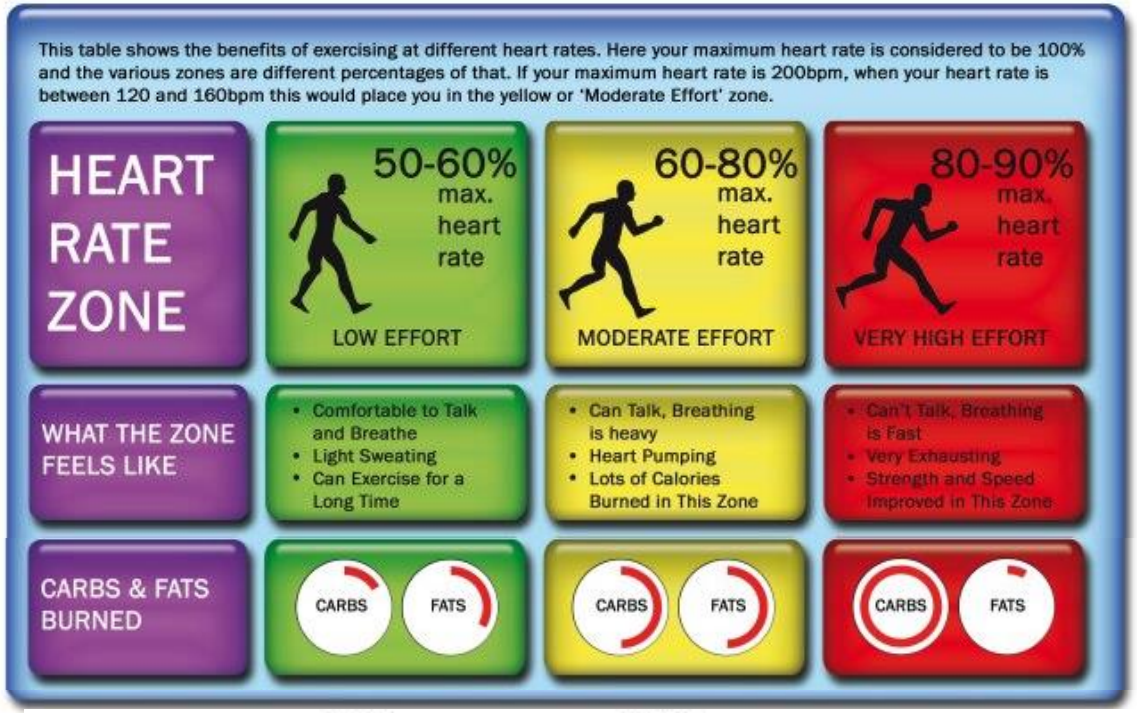
➢ The intensity of physical activity can be determined by heart rate, or according to other parameters

- ✓ **HR_{max}= 220 – age** nebo **HR_{max}= 207 - (0,7 x age)**
- ✓ **HRR = HR_{max}- resting HR**
- ✓ **1 MET:** the energy requirement of one hour of lying still (cca. 1 kcal/kg)
- ✓ **VO_2 max:** the maximum amount of oxygen that organism can use

Table 1
Categories of exercise intensity and the subjective and objective measures [both absolute and relative] accompanying each category. The relative intensity measures such as % HR_{max}, %HRR [heart rate reserve = HR_{max} − resting HR] and %VO_{2max} [maximal oxygen uptake] will not always correspond to the same RPE among individuals nor will the ability of clients to exercise for a specific duration at each intensity since this varies depending on training status and other personal characteristics. Subjective measures are from Borg's RPE scales where C = category scale [6–20] and C-R = category-ratio scale [0–10] [7].

Intensity category	Objective measures	Subjective measures	Descriptive measures
SEDENTARY	< 1.6 METs < 40% HR_{max} < 20% HRR < 20% VO_{2max}	RPE (C): < 8 RPE (C-R): < 1	• activities that usually involve sitting or lying and that have little additional movement and a low energy requirement
LIGHT	1.6 < 3 METs 40 < 55% HR_{max} 20 < 40% HRR 20 < 40% VO_{2max}	RPE (C): 8-10 RPE (C-R): 1-2	• an aerobic activity that does not cause a noticeable change in breathing rate • an intensity that can be sustained for at least 60 minutes
MODERATE	3 < 6 METs 55 < 70% HR_{max} 40 < 60% HRR 40 < 60% VO_{2max}	RPE (C): 11-13 RPE (C-R): 3-4	• an aerobic activity that is able to be conducted whilst maintaining a conversation uninterupted • an intensity that may last between 30 and 60 minutes
VIGOROUS	6 < 9 METs 70 < 90% HR_{max} 60 < 85% HRR 60 < 85% VO_{2max}	RPE (C): 14-16 RPE (C-R): 5-6	• an aerobic activity in which a conversation generally cannot be maintained uninterupted • an intensity that may last up to about 30 minutes
HIGH	≥ 9 METs ≥ 90% HR_{max} ≥ 85% HRR ≥ 85% VO_{2max}	RPE (C): ≥ 17 RPE (C-R): ≥ 7	• an intensity that generally cannot be sustained for longer than about 10 minutes

doi:10.1016/j.jsams.2009.09.008



https://amazonleisure.wordpress.com/2016/09/30/featured-content-3/

https://neikid.ee/images/617981.png

Nutrition

- Macronutrients
  - Substances necessary for life received in relatively large quantities through food as a source of energy, a structural element, etc. (alcohol is also a source of energy, but it is not a macronutrient)
  - Excessive intake - formation of fat reserves
  - ✓ Carbohydrates
  - ✓ Fats
  - ✓ Proteins
- Micronutirients
  - Substances necessary for the proper functioning of the organism, taken in small amounts through food, often in connection with macronutrients (the organism is unable to synthesize micronutrients)
  - Excessive intake - potential toxicity
  - ✓ Vitamins
  - ✓ Minerals
- Hydration

Good sources of nutrients

	Carbohydrates + (10-30%)	**Fats + (20-100%)**	**Proteins + (10-30%)**
Carbohydrates -		Nuts, seeds, olive oil, cheese	Eggs, meat, fish
Fats -	Pasta, rice, cereal, bread, legumes, fruits, vegetables		Nonfat Greek yogurt, cottage or cream cheese, turkey or chicken breast, lean ground beef
Proteins -	Fruits and vegetables	Avocado, olive oil, coconut milk	

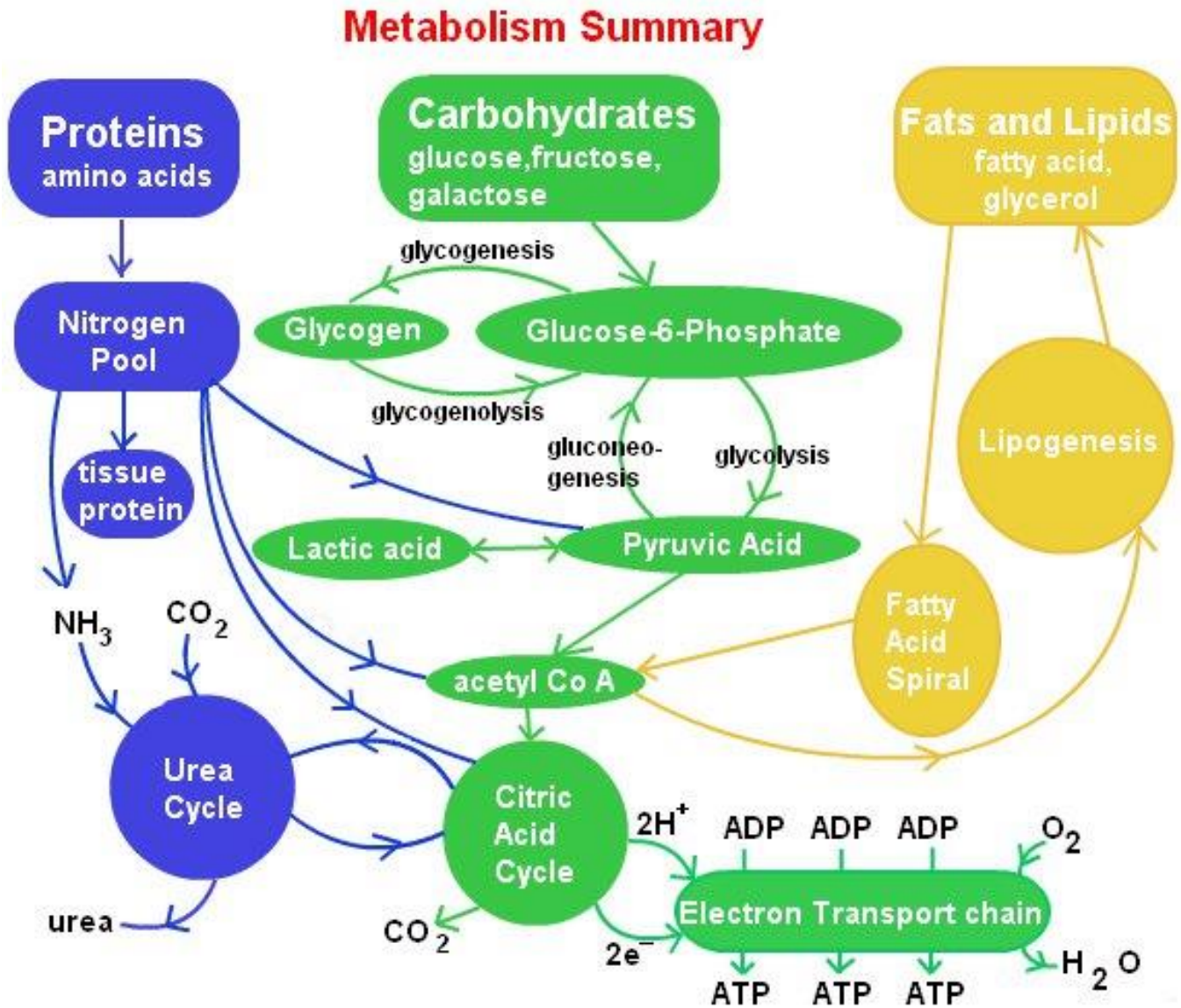
Caloric need

Gender	Age	Sedentary	Moderate	Active
Child	2-3	1000	1000	1000
Female	4-8	1200	1400	1800
	9-13	1600	1600	2200
	14-18	1800	2000	2400
	19-30	2000	2000	2200
	31-50	1800	2000	2200
	51+	1600	1800	2200
Male				
	4-8	1400	1600	2000
	9-13	1800	2200	2600
	14-18	2200	2800	3200
	19-30	2400	2800	3000
	31-50	2200	2600	3000
	51+	2000	2400	2800

https://readywise.com/blogs/readywise-blog/how-many-daily-calories-will-i-need

- Energy per gram
  - Fats – 38 kJ (9 kcal)
  - Proteins – 17 kJ (4 kcal)
  - Carbohydrates – 17 kJ (4 kcal)
  - Alcohol – 30 kJ (7 kcal)

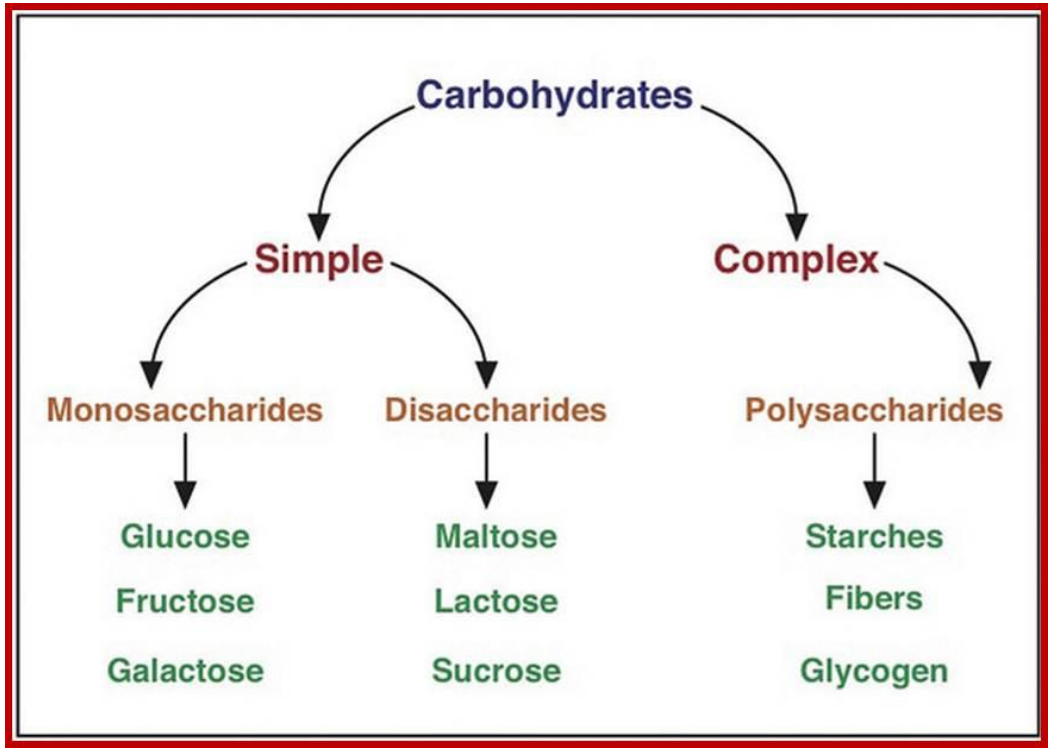
- Optimal proportion
  - Carbohydrates – 50%
  - Fats – 30 %
  - Proteins – 20 %



https://www.quora.com/Whats-carbohydrate-metabolism

Carbohydrates

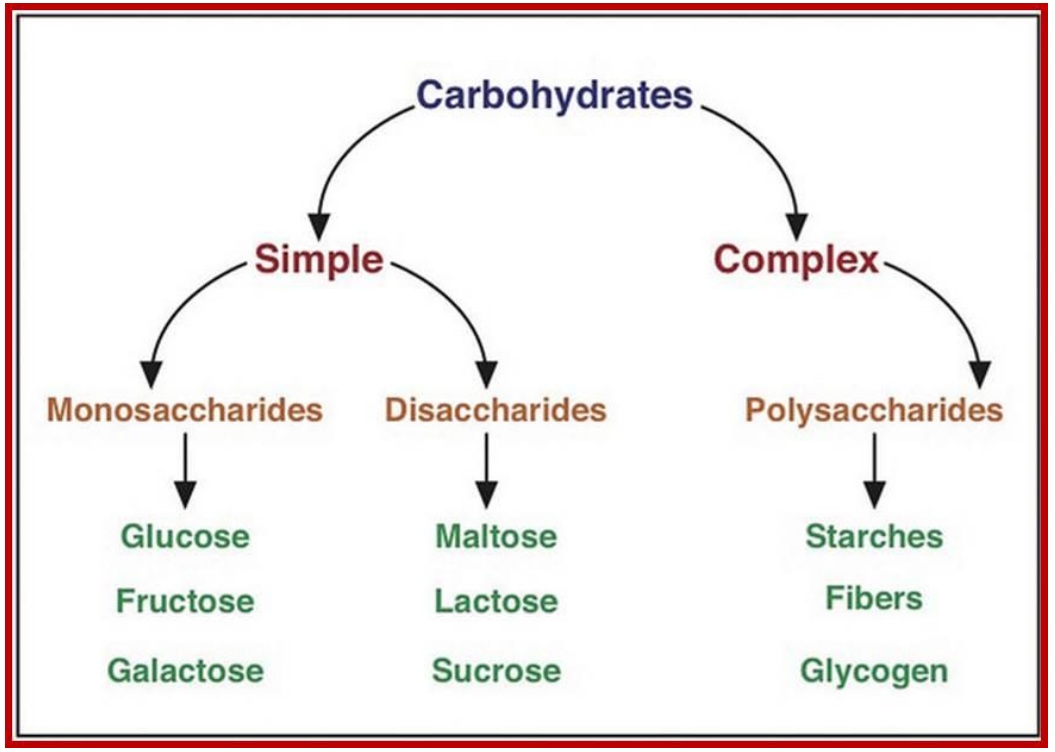
- Building blocks – glucose, fructose, galactose
- Simple
  - Mono/oligosacharides
  - Sweet taste, easy digestibility, fast absorption
  - ✓Sugar, sweets, white flour
  - ✓Ripe fruit (also contains vitamins, minerals, fiber and therefore considered suitable)



https://en.wikipedia.org/

Carbohydrates

- Complex
  - Polysacharides
    - Starch, fiber
    - Stach
      - Longer digestion time, slow to zero absorption
      - Low glycemic index (better insulin response)
      - ✓ Bread, cereals, rice, pasta, legumes, vegetables



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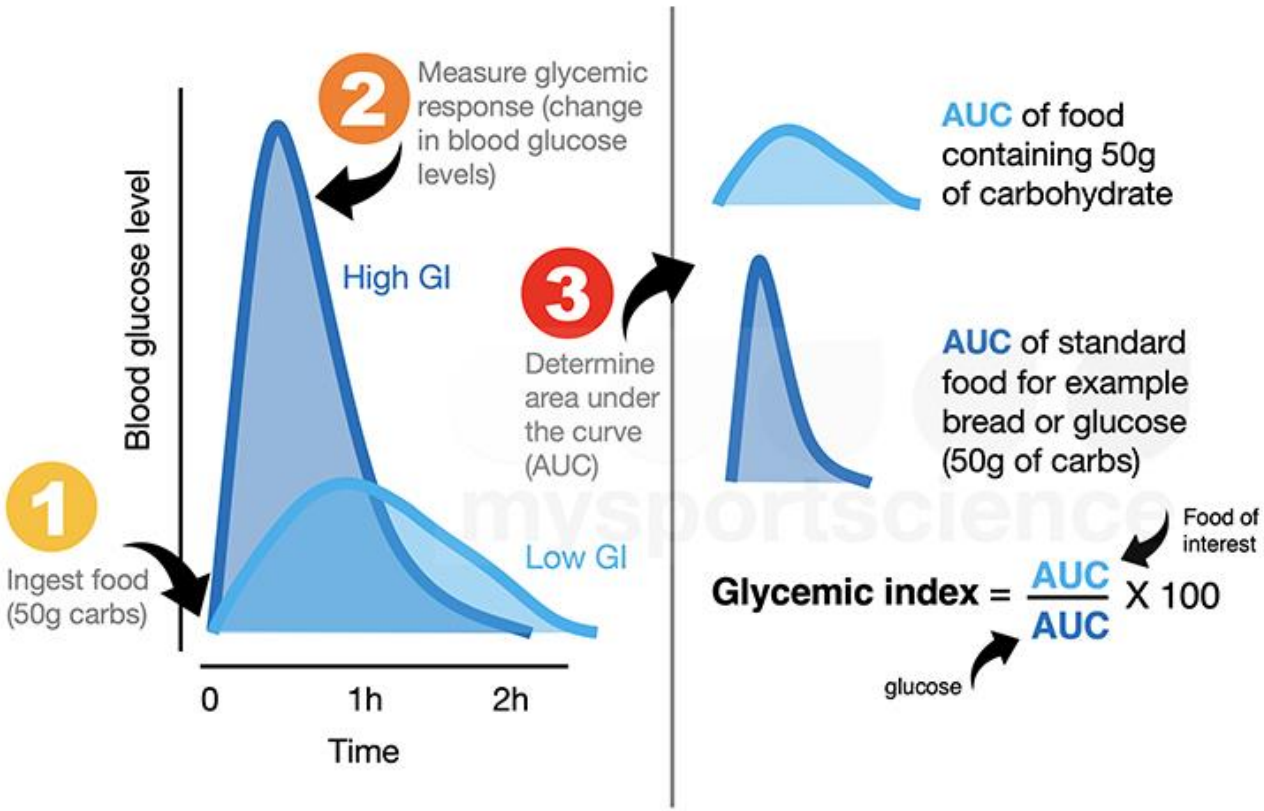
Glycemic index



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www.mysportscience.com

High GI (70-100)
Carbohydrates which break down **quickly** during digestion, releasing blood sugar **rapidly** into the bloodstream

Medium GI (56-69)
Carbohydrates which break down **moderately** during digestion, releasing blood sugar **moderately** into the bloodstream.

Low GI (0-55)
Carbohydrates which break down **slowly** during digestion, releasing blood sugar **gradually** into the bloodstream

https://www.mysportscience.com/post/glycemic-index-useful-or-useless

Glycemic index

Glycemic Load
✓ Takes portion size into account
✓ GL (per serving) = GI/100 x carbohydrate content per serving (g)

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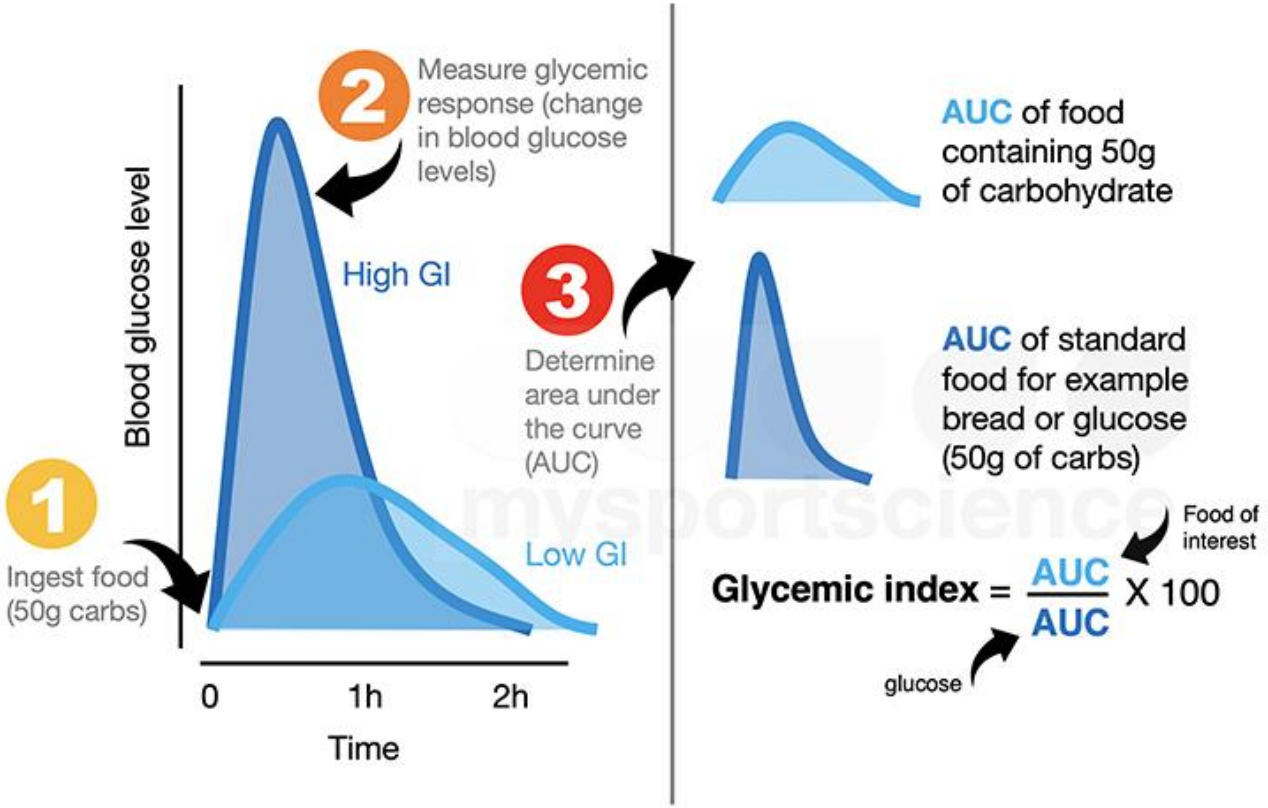

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Natural vs. added sugar

- Natural sugar
  - Fruits, vegetables, dairy products
  - Naturally bound to another nutrient – vitamins, minerals, macronutrients, water
- Added sugar
  - Added during food processing in addition to natural sugar
  - A lot of calories, a minimum of other nutrients
  - Increases cardiovascular risk (via increased triglycerides)

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Recommended intake of added sugar per day

✓ **Maximum – cca. 30g**

✓ **Reality – cca. 80g**

Sources of added sugar

✓ **Sweets**

✓ **Sweet drinks**

✓ **Flavored yogurts**

✓ **Candied fruit**

✓ **Ketchups, dressings, sauces**

✓ **Sausages**

✓ **Pastry**

Fructose vs. fructose syrup

- Fructose
  - Naturally present in the fruit in connection with fiber, vitamins, enzymes
- Glucose-fructose syrup
  - Inexpensive sweetener made from starch (corn, wheat)
  - Starch hydrolysis to glucose, glucose isomerization to fructose, filtration and water removal
  - Sweeter than white sugar
  - Calorically dense, no other nutrients
  - Increases cardiovascular risk (via increased triglycerides))
  - Highly addictive (PMID: 1875782, PMID: 20800122)

Artificial sweeteners

- More types, because it is difficult to mimic a sweet taste - individual - everyone has to find what he likes
- Stevia, aspartam, sucralose
  - No calories, sweeter than white sugar
  - They can disrupt the microbiome
  - Addictive
  - Potential disturbtion of metabolism
- Polyols – xylitol, sorbitol, erythritol
  - Caloric content, however less calories than white sugar
  - Less/as sweet as white sugar
  - May cause GIT distress (FODMAP)

FODMAP

- Fermentable carbohydrates may potentialy irritate GIT
- Problems ranging from intestinal discomfort to diarrhea
- F - Fermentable and refers to the following groups of short-chain carbohydrates or sugars:
- O - oligosaccharides
- D - disaccharides
- M - monosaccharides
- P - polyols

Recommendations for carbohydrate intake

- As much complex carbohydrates as possible from natural sources
  - Fruits, vegetables, nuts, seeds, whole grains, brown rice
  - Carbohydrates linked to vitamins, minerals, fiber, proteins...
- Fewer complex refined carbohydrates
  - White rice, white bread, regular pasta
  - Industrial food processing mainly destroys fiber
- As little added sugar as possible
  - Empty calories - only energy, a minimum of other nutrients

Fiber

- Recommended intake approx. 30g/day (larger amounts may cause diarrhea)

➢ Soluble
  - Binds water and forms a gel – increases in volume
  - Fermentation in the intestineě
    - Prebiotic – nutrient for the microbiome
    - Partial absorption – source of energy
  - Regulation of fat and carbohydrate digestion

  ✓Oatmeal, apples, peaches, sweet potatoes

➢ Insoluble
  - Does not ferment
  - Increases stool volume (shortens passage time)
  - Dilutes/binds waste materials that are potentially toxic

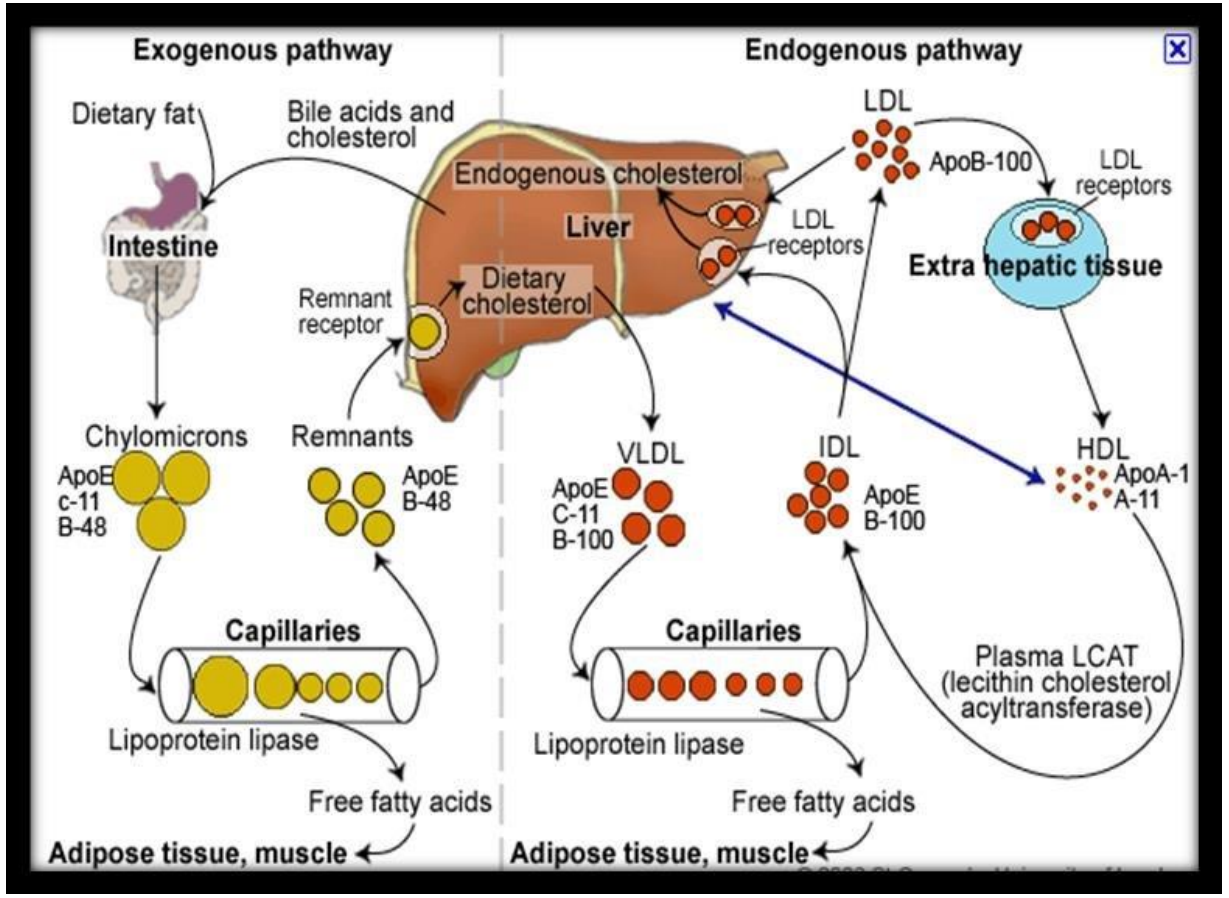
  ✓Skin of fruit and vegetables, whole grain bread, nuts

Benefits of fiber

- Feeling of satiety
- Favorably affects cholesterol and blood sugar levels (slowing down absorption)
- Favorably affects the microbiome (prebiotic)
- beneficial effect on laxation
  - Soluble fiber softens the stool
  - Insoluble fiber thickens the stool
- Reduces the risk colorectal carcinoma development (binding of potentially harmful substances)

Fats

- Structural function – membranes
- Brain – 60% fat content
- Energy storage
  - Preferred fuel for daily activities and low-intensity physical activity – saving glucose for the brain and erythrocytes
  - The highest utilization during caloric deficit
- Beta oxidation requires glucose as a source of oxaloacetate for the citrate cycle, when deficient, acetyl CoA is metabolized to ketone bodies ("fats burn in a carbohydrate flame")



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Fats

- Structural function – membranes
- Brain – 60% fat content
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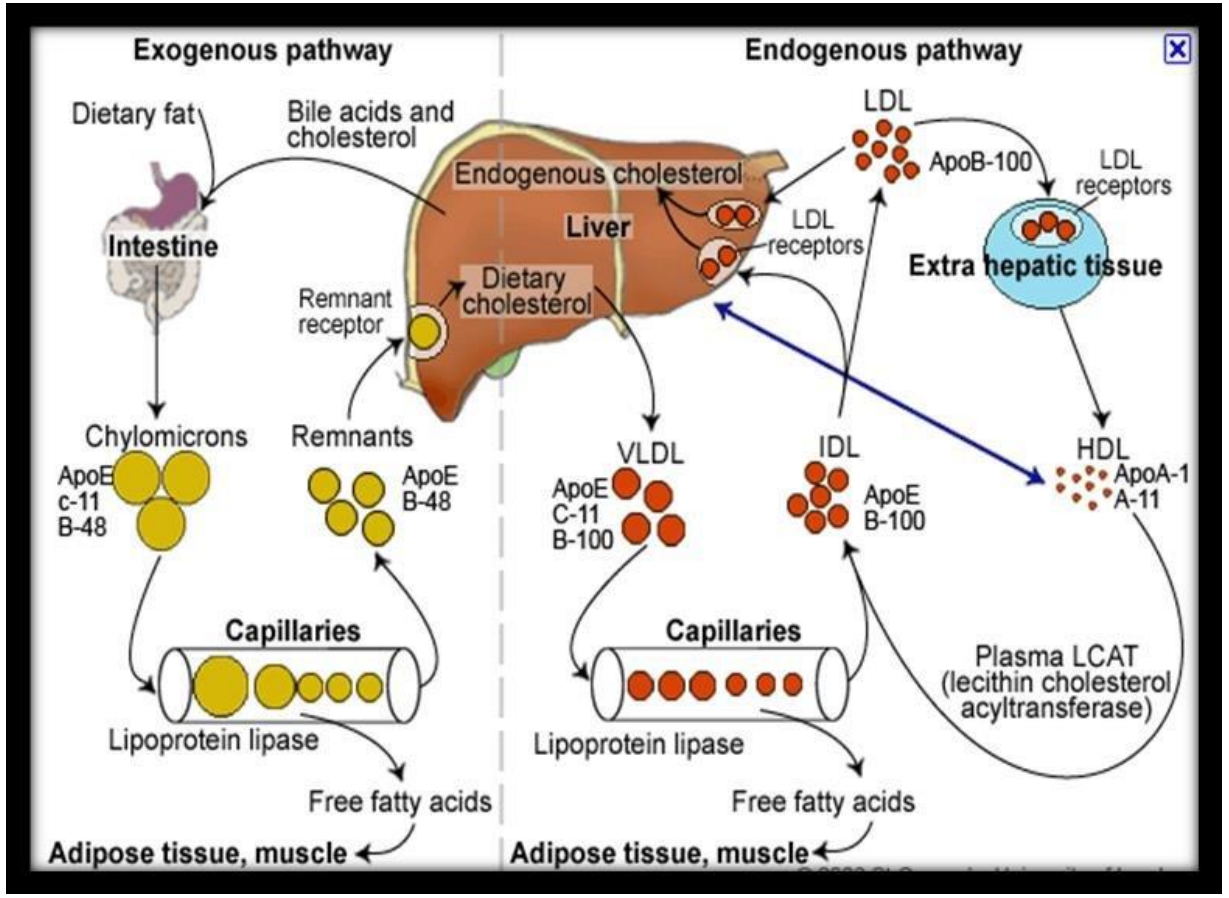

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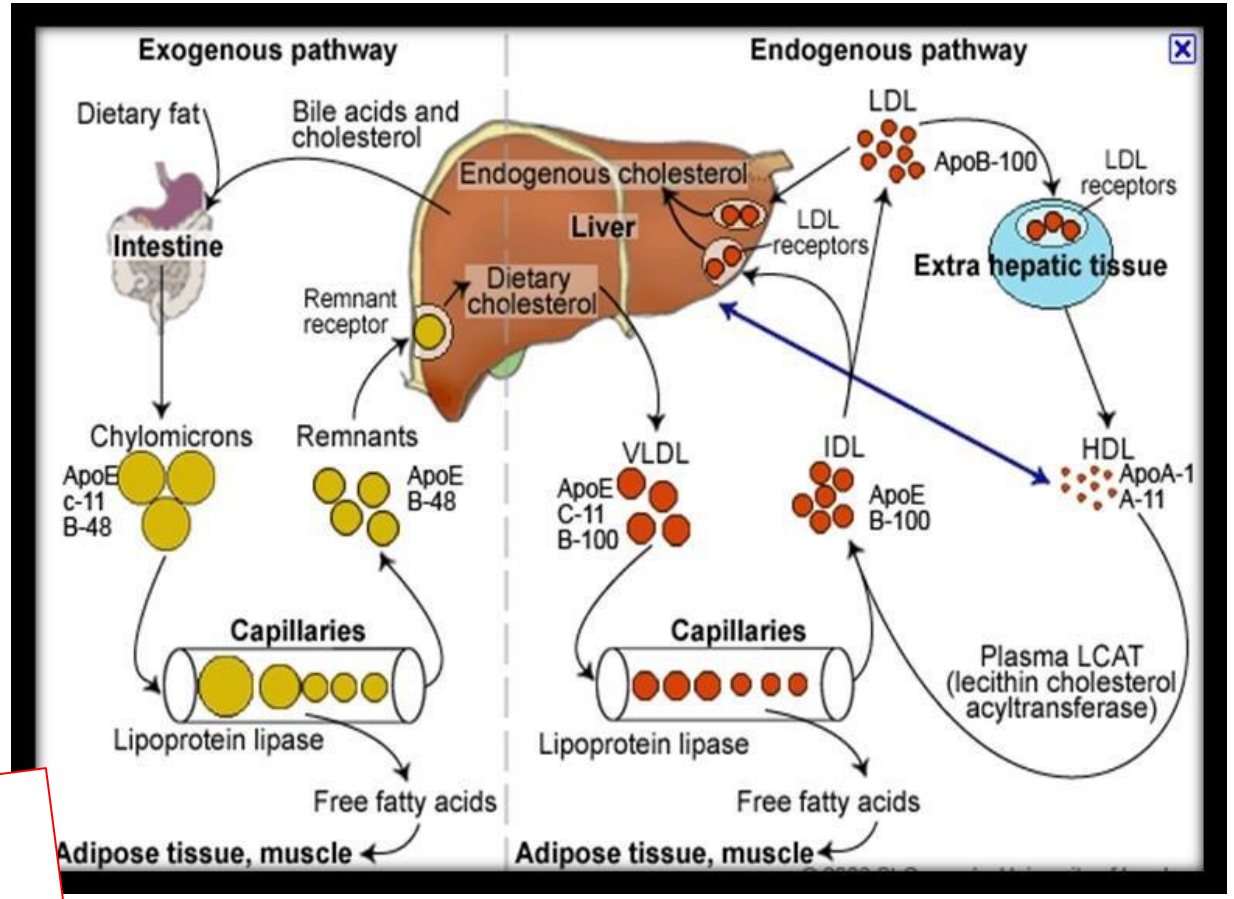
Tuky

- Strukturální funkce – membrány
- Mozek – 60% tuku
- Zásoba energie
  - Preferované palivo pro každodenní aktivity a fyzickou aktivitu o nízké intenzitě - snaha šetřit glukózu pro mozek a erytrocyty
  - Největší využití v případě kalorického deficitu
- Beta oxidace vyžaduje glukózu jako zdroj oxalacetátu pro citrátový cyklus, při nedostatku se acetyl CoA metabolizuje na ketolátky („tuky hoří v ohni sacharidů“)



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Sources of dietary fat

- ➢ **Natural sources**
- ✓ **Dairy products, meat, fish, nuts and seeds, oil, olives, avocado**
- ➢ **Industrially processed food**

Unhealthy fats

- **Saturated fatty acids**
  - Solid at room temperature
  - A significant risk factor for increased LDL (cardiovascular risk)
  - They should represent maximally 10% of caloric intake

  ✓Meat, dairy products, coconut and palm oil
- **Trans fatty acids**
  - They are produced industrially during the solidification of fats (hydrogenation of unsaturated fatty acids)
  - Solidification of fats - extension of shelf life
  - They raise LDL and lower HDL (very high cardiovascular risk)
  - Recommended intake: 0

Healthy fats

- **Monounsaturated (MUFA), polyunsaturated (PUFA) fatty acids**
  - Avocado, nuts, seeds, salmon, tuna, mackerel
  - **Omega-3 a Omega-6 fatty acids**
    - Essential PUFAs
    - In addition to the positive effect on HDL/LDL, important for immunity and embryonic development (especially omega-3)
    - Omega-6 (linolenic acid)
      - Recommended intake approx. 15 g/den
      - ✓ Vegetable oils, soybeans
    - Omega-3 (kyselina alfa-linolenová) –
      - Recommended intake approx. 1,5 g/den
      - ✓ "fatty fish", linseed, lineseed oil

Fats

- Fat is preferentially used as fuel at rest or during low-intensity activity (approx. up to 70% HRMAX)
- Fat intake does not automatically lead to the formation of fat stores
- Everything depends on caloric intake (excess calories from protein / carbohydrates are converted into fat stores too)
- However, fat is calorically denser, so with a caloric surplus, fat represents 2 times more energy than carbohydrates or protiens
- Low/zero fat foods may not be lower in calories as they may contain more sugar to enhance taste (marketing)

Proteins

- Dietary proteins are metabolized into amino acids
- In small intestine, the amino acids are absorbed to the circulation from where they are available for the needs of cells
- Amino acids are not stored, excess amino acids are converted into glucose-glycogen or fatty acids
- In the case of adequate caloric intake, amino acids are conserved and fat/carbohydrates are used as the preferred energy source
- In the case of chronic caloric deficit
  - Insufficient production/catabolism of immunoglobulins
  - Muscle catabolism (especially during inactivity)

Amino acids

- Essential
  - ✓Valine, leucine, isoleucine, phenylalanine, tryptophan, threonine, methionine, lysine
- Semi-essential
  - Essential in childhoodí
  - ✓Histidine, arginine
- Conditionally essential
  - They can be synthesized from essential amino acids
  - ✓Tyrosine (from phenylalanine), cysteine (from methionine)
- Non-essential
  - ✓Glycine, alanine, serine, aspartate, glutamate, asparagine, glutamine, proline

➢ Complete protein sources

- They contain all essential amino acids

✓Meat, fish, eggs, dairy products, soy, buckwheat, quinoa

➢ Incomplete protein sources

- They lack at least one essential amino acid
- It is necessary to combine several sources

✓Beans, nuts, seeds, whole grains, vegetables

Recommended intake
Minimum: 0,8 g/kg/day
✓ More in case of regular physical activity

➢ Endurance training
✓ Running, cycling, swimming
✓ 1,2-1,4 g/kg/day
➢ Strength training
✓ 1,4-2 g/kg/day
➢ Consume proteins together with polysaccharides after training for better muscle regeneration

Protein supplements

- Most often based on whey protein or casein
- Casein - the main protein in mammalian milk
  - It represents up 80% of cow's milk proteins
  - Milk coagulation – precipitated casein + whey
    - Acid precipitation – using acids produced by lactic acid bacteria (mainly lactic acid)
    - ✓ Yogurts, cottage cheese, some cheeses
    - Sweet precipitation - with the help of rennets (chymosins – protease enzme splitting casein, products subsequently precipitate even without acidification)
    - ✓ Majority cheeses
- Whey – a by-product of milk production
  - Rich in vitamins, minerals, proteins, lactose
  - ✓ Žinčica, protein powders

Mikronutrienty

WATER-SOLUBLE VITAMINS
- ✓ Thiamin
- ✓ Riboflavin
- ✓ Niacin
- ✓ Vitamin B6
- ✓ Vitamin B12
- ✓ Folate
- ✓ Pantothenic acid
- ✓ Choline
- ✓ Vitamin C
- ✓ Biotin

FAT-SOLUBLE VITAMINS
- ✓ Vitamin A
- ✓ Vitamin D
- ✓ Vitamin E
- ✓ Vitamin K

VITAMINS & MINERALS

Eating a balanced diet of whole foods is the ideal way to get the proper amount of micronutrients to support the structural and functional needs of the body.

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MACROMINERALS
- ✓ Sodium
- ✓ Potassium
- ✓ Chloride
- ✓ Calcium
- ✓ Phosphorus
- ✓ Magnesium

TRACE ELEMENTS
- ✓ Chromium
- ✓ Copper
- ✓ Fluoride
- ✓ Iodine
- ✓ Iron
- ✓ Manganese
- ✓ Molybdenum
- ✓ Selenium
- ✓ Zinc

Mikronutrienty

VITAMIN A

BENEFITS

- energy production
- nerve function
- immune function
- red blood cell formation (B12)
- reduces birth defects (folate)

SOURCES

- butternut squash
- carrots
- kale
- liver
- mango
- spinach
- sweet potatoes

VITAMIN B

BENEFITS

- vision
- reproduction
- immune function
- growth

SOURCES

- butternut squash
- carrots
- kale
- liver
- mango
- spinach
- sweet potatoes

VITAMIN C

BENEFITS

- antioxidant
- collagen formation
- iron absorption

SOURCES

- bell pepper
- Brussels sprouts
- citrus fruits
- kiwi
- tomato

VITAMIN D

BENEFITS

- bone mineralization
- calcium absorption
- immune function

SOURCES

- sunshine
- eggs
- fortified milk
- salmon
- tuna

VITAMIN E

BENEFITS

- antioxidant
- immune function

SOURCES

- fortified cereals
- seeds
- nuts
- vegetable oil

VITAMIN K

BENEFITS

- blood clotting
- bone health

SOURCES

- asparagus
- broccoli
- Brussels sprouts
- dark leafy greens

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Mikronutrienty

CALCIUM

BENEFITS

- bone and tooth health
- muscle contraction
- nerve signaling
- heart rate regulation

SOURCES

- cheese
- fortified cereals
- milk and soy milk
- yogurt

POTASSIUM

BENEFITS

- important electrolyte
- muscle contraction
- nerve signaling
- fluid balance and hydration

SOURCES

- baked potato with skin
- beans
- dark leafy greens
- dried apricots

IODINE

BENEFITS

- thyroid function
- cell metabolism

SOURCES

- baked potato with skin
- cod
- dried seaweed
- iodized salt
- milk

SODIUM

BENEFITS

- important electrolyte
- muscle contraction
- nerve signaling
- fluid balance and hydration

SOURCES

- bouillion and soups
- cheese
- deli meat
- pickled foods
- salt
- soy sauce

IRON

BENEFITS

- red blood cell formation
- oxygen transport
- immune function
- enzyme and DNA formation

SOURCES

- beans
- beef and lamb
- clams
- dark leafy greens
- liver
- nuts
- pumpkin seeds

ZINC

BENEFITS

- immune function
- cell division
- wound healing
- carbohydrate metabolism

SOURCES

- beef and lamb
- cocoa
- oysters
- pumpkin seeds
- wheat germ

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Micronutrients

SODIUM ACCUMULATION IN PROCESSED VS. UNPROCESSED FOODS	
Peach (0mg Sodium)	**Tomato** (6mg Sodium)
Canned Peaches (8mg Sodium)	**Tomato Paste** (73mg Sodium)
Peach Pie (326mg Sodium)	**Marinara Sauce** (515mg Sodium)

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Hydration

- Recommended daily intake
  - ✓Men: 3,7 l
  - ✓Women: 2,7 l
  - ✓More during physical activity/ hot day
- About 20% of the recommended intake is from food
- Alcohol – inhibition of antidiuretic hormone secretion

MUNI
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