Difference between average and maximum lifespan

Average and maximum lifespan

When dealing with the question of mortality, we distinguish between **average life expectancy**, which characterises the expected lifespan of a certain age in a given area or population and **maximum life expectancy**, i.e. the assumption of reaching the highest possible age under the most favourable conditions.

Average life expectancy

Average life expectancy - or the **hope of living** to a certain age with a certain probability. Where child mortality is high, average life expectancy will be lower than in areas where children live to adulthood in large numbers. It also depends on many other factors, such as **belonging to a social class** (richer people can afford better health care), the **state of public health** (reflects the maturity of the state - in Japan the average life expectancy is 81 years), the ongoing **war** , the prevalence of HIV and TB in the population, also **famines**, **quality of life**, accident rate in the given locality, etc. Nowadays (year 1998), the average life expectancy of men in Czech republic is around **71 years** , for women around **78 years**. 80 years ago, it was 47 years for men and about 50 years for women. In pre-industrial times, if someone survived puberty , they had a high probability of living to the same age as we do today, but due to youth mortality, life expectancy was lower (20–30 years). The increase in the average life expectancy is related to advances in medicine, better living conditions, a less dangerous life and, of course, the high quality of public health care compared to past times.

Maximum lifespan

The maximum life expectancy - for humans is **115-120 years**, under current living conditions even somewhere around 125 years, but there were mentions of people living longer. In principle, human age **does not increase**, even earlier people lived to be over a hundred years old - we have evidence of this from antiquity. However, the probability of living to an older age, the average life expectancy, is increasing. So there are more people living to old age. **Here too, a number of factors** influencing life play a role, such as **the environment** in which we live (radiation, industrial areas, cities x countryside), **diet** and its composition (proportion of vegetables and fruit, seaside diet with a higher proportion of unsaturated fatty acids x fatty basis of the menu in the Czech Republic), **physical condition** (related to movement, strengthening, maintaining your body), **abuse** (smoking , addiction to alcohol , drugs, caffeine, etc.) and mental state will also be an important aspect

Genetic influences

The influence of the gene - genes apply in relation to life expectancy in three different ways:

1. A genetically coded program, which science calls **programmed aging** , or **programmed death** and the presence of which is necessary both to guarantee living space for the new generation and to protect against excessive load of genetic material with mutations arising during life (**shortening of telomere length** after mitotic division).
2. It is about the overall impact on the life span of all genetically programmed functions of organisms, which in themselves do not have a direct effect on the life span (reproduction, adaptation, differentiation of cells and tissues).
3. It is a genetic consequence on the body's functions, which are not controlled by the "death program", but which significantly affect the length of life - it is mainly about immunity , metabolism and regeneration - from a biochemical point of view, it is mainly about the production of key substances - vitamins , hormones , enzymes and neurotransmitters - i.e. about the functioning of functions that significantly affect the length and quality of life.

It is obvious that **longevity is primarily determined genetically** , so it will surely be possible to extend human life one day by means of gene manipulation. However, each gene corresponds to a certain process/state of the organism, which is why we can influence the key element even without genetic manipulation. The closest connection between genes and bodily functions is found in the most effective substances, in hormones, which are important tools in the "management" of the organism, its functions, organs and developmental processes.

1. We can influence the genetic program (programmed death) only by intervening in the human genetic program itself - in the DNA structure and changing it (gene therapy). Ethical aspects apparently **do not allow** this possibility for modern man and with the current population explosion .
2. We can influence the complex contribution of the body's functions to the length of life by knowing and mapping all the relationships between individual physiological functions and subsequent subtle improvements, which we cannot do anything wrong with. In this way, **the length of life can be extended, but usually not beyond a certain limit** . However, much of the time we gain must be devoted to lifestyle monitoring and various complementary therapies.
3. For human intervention, it appears to be **the most effective** area of the consequences of our genetic program - the creation of enzymes and hormones. Due to their longevity, enzymes can be divided into **three overlapping groups** :
   1. There are enzymes and coenzymes that help us assimilate nutrients.
   2. Those that support the activity of organs, supply energy to the cell and help to clean the body.

3. Finally, enzymes that protect us from free radicals and which we refer to as enzymes and coenzymes with an antioxidant effect

In summary, we can say that the influence of these substances on longevity is **considerable**, science has most convincingly proven this precisely with enzymes, coenzymes and enzymatic functions with an **antioxidant effect** . We must be aware that free radicals can also attack genetic material, which serves to restore individual cells and organs, and whose damage can be **irreversible** . The aging of the genetic material has a particularly significant effect on the aging of the organism. Some **antioxidants** supplied separately can significantly extend the life of, for example, laboratory mice. It is encouraging that some of the protective and life-prolonging nutrients (antioxidants, enzymes, coenzymes, vitamins) can already be supplied by the pharmaceutical industry in the form of **supplements** and that there are other, even more promising ways on the horizon in which enzymes, for example, can prolong and improve human life. New synthetic antioxidants have also been developed that are extremely effective in many ways. So far, they are only added to dog food as part of testing, but it seems that there is nothing preventing their extension to human medicine and diet therapy as well.

The theory of antagonistic pleiotropy - characterizes conditions where certain genes provide advantages to the carrier in youth and reproduction, but harm the carrier later in life. E.g.: Huntington's disease - AD disease (there are two theories, according to one, the disability has psychological promiscuity as one of the manifestations = more children, according to the second, the incidence of cancer among the disabled is lower than among the same age in the general population); hemochromatosis - AR disease (increased storage of Fe - advantage against plague); sickle cell disease (heterozygote – advantage in malaria); Hereditary thrombophilia (tendency to thrombosis - the advantage **is faster stopping of bleeding** in case of injury or childbirth, disadvantage in case of long immobilization).

Current possibilities of influence

Caloric restriction

Caloric restriction – **reducing the amount** of food while maintaining its biological quality. An example is given in an experiment on mice, which live an average of 28 months, and when food is restricted to 25%, they live up to 47 months. Reducing the amount increases life span, reduces oxidative stress, the incidence of tumors and slows aging. The mechanism of action could be based on a slower metabolism and devoting more energy to maintenance. **The signaling of IGF-1** (somatomedin C) and insulin decreases, while the activity of deacetylases = sirtuins, which act on histones and simultaneously suppress transcription and DNA recombination, increases. Whether it also works in humans is currently being investigated by the **CALERIE** project (**C**omprehensive **A**ssessment of **L**ong-term **E**ffects of **R**educing **I**ntake of **E**nergy).

Physical activity

Physical activity – stimulates biogenesis and restoration of mitochondria in muscles, adequate doses of oxidative stress increase resistance to greater oxidative stress through the mechanism "what doesn't kill you, makes you stronger" – the formation of ROS in muscles (Reactive Oxygen Species = reactive forms of oxygen).

Diet composition

Diet composition – a higher proportion **of fruit and vegetables** in the diet (0.5 kg/day) is associated with a lower risk of cardiovascular diseases, diabetes and some types of cancer (lung, mouth, pharynx). The diet should be adequate, because obesity entails many problems and risks.

Links

related articles

- Basic reactive forms of oxygen and nitrogen: properties, reactions, main sources in the organism, significance in pathogenesis
- Antioxidant protection of the human body
- Biochemical basis of organism aging. Radical/mitochondrial theory, aging as a catabolic failure, relationship to chronic inflammation
- The importance of mitochondria in cell death (apoptosis and necrosis) and physiological aging of the organism
- Resveratrol

Rescources

- lecture; MUDr. J. Pláteník, 1st Faculty of Arts, UK (https://ubeo.lf1.cuni.cz/Studenti/Texty/Starnuti_151209_hand out1.pdf)
- Population — Annual Time Series: Chart 5, Life Expectancy at Birth and Infant Mortality, 1870–2018 (https://w ww.czso.cz/csu/czso/obyvatelstvo_hu)
- An article on 'The longevity of turtles applicable to human biochemistry' (http://darius.cz/ag_nikola/cl_zelva.ht

ml)
- Age and Lifespan (https://www.katyd.cz/doma/maximalni-delka-zivota-je-125-let.html)
- Article; Huntington's Chorea (https://www.osel.cz/2934-huntingtonova-evolucni-rana-pod-pas.html)
- Can the plague be outwitted? Yes! A genetic disorder! (https://21stoleti.cz/2007/08/17/da-se-prelstit-mor-ano-genetickou-poruchou/)
- Article; caloric restriction and life extension