Difference between average and maximum life expectancy

In the question of mortality, we distinguish between **life expectancy**, characterising the expected life expectancy at a given age in a given area or population, and **maximum life expectancy**, or the expectation of reaching the highest possible age under the most favourable conditions.

Life expectancy

Life expectancy - or **the chance of living** to a certain age with a certain probability. Where child mortality is high, 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 **social class** (richer people can afford better health care), the **state of public health care** (reflecting the maturity of the country - in Japan life expectancy is 81 years), the **ongoing war**, the prevalence of HIV and TB in the population, as well as **famines**, **quality of life**, injury rates in the area, etc. Today (1998) the average life expectancy for men in this country is about **71 years**, for women about **78 years**. 80 years ago it was 47 years for men and about 50 years for women. In the pre-industrial period, if someone survived puberty, they had a high probability of living to the same age as we do today, but following the youth mortality rate, the average life expectancy was lower (20-30 years). The increase in average life expectancy is related to advances in medicine, better living conditions, less dangerous living and of course the high quality of public health compared to previous times.

Maximum life expectancy

Maximum lifespan - for humans is **115-120 years**, with current living conditions even somewhere around 125 years, but there have been mentions of people living longer. Human age is basically **not getting longer**, even in the past people lived to be over 100 years old - we have evidence of this from antiquity. But the probability of living to a higher age, life expectancy, is increasing. So there are more and more people living to old age. Here too, a **number of factors** play a role in influencing life, such as the **environment** in which we live (radiation, 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 diet in the Czech Republic), **physical condition** (related to exercise, strengthening, maintaining one's body), **abusus** (smoking, addiction to alcohol, drugs, caffeine, etc.) and **mental state** will also be an important aspect.

Genetic influences

Gene influence - Genes exert their influence on lifespan in three different ways:

1. A genetically encoded program, which science calls **programmed aging** or **programmed death**, and whose presence is necessary both to guarantee the living space for the next generation, and to protect against overloading the genetic material with mutations arising during life (**shortening telomere length** after mitotic division).
2. It is about the overall impact on lifespan of all genetically programmed functions of organisms that do not in themselves have a direct impact on lifespan (reproduction, adaptation, differentiation of cells and tissues).
3. It is the genetic impact on the functions of the organism that are not controlled by the "death programme" but which significantly affect life expectancy - in particular immunity, metabolism and regeneration - from a biochemical point of view, especially the production of key substances - vitamins, hormones, enzymes and neurotransmitters - i.e. the activity of functions that significantly affect life expectancy and quality of life.

It is clear that **longevity is determined primarily by genetics**, so it will certainly be possible to extend human age through gene manipulation one day. However, each gene corresponds to a specific process/state of the organism and therefore we can influence a key element without genetic manipulation. The closest link between genes and bodily functions is found in the most potent substances, hormones, which are important tools in "controlling" 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 considerations **do not seem to admit this possibility** for contemporary man and the current population explosion.
2. We can influence the complex contribution of bodily functions to life expectancy by knowing and mapping all the relationships between individual physiological functions, and then making subtle tweaks that we can do no wrong. In this way, **lifespan can be extended, but usually not beyond a certain point**. Much of the time we gain, however, must be devoted to monitoring our lifestyle and performing various complementary therapies.
3. For human intervention, the most effective area seems to be the consequences of our genetic program - the production of enzymes and hormones. Because of longevity, we can divide enzymes into **three overlapping groups**:

- There are enzymes and coenzymes that help us assimilate nutrients.
- Those that support organ function, provide energy to the cell and help the body clean up.

- Finally, enzymes that protect us from free radicals, which we refer to as enzymes and coenzymes with antioxidant activity.

In summary, we can say that the impact of these substances on longevity is **considerable**, and it is the enzymes, coenzymes and enzymatic functions with **antioxidant effect** that science has proven most conclusively. We must remember that free radicals can also attack the genetic material that serves to regenerate individual cells and organs, the damage to which can be **irreversible**. The ageing of genetic material has a particularly pronounced effect on the ageing of the organism. Some **antioxidants**, when delivered alone, can significantly **prolong** the life of laboratory mice, for example. It is encouraging that some of the protective and life-extending 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 for e.g. enzymes to extend and improve human life. New synthetic antioxidants have also been developed that are extremely effective in many ways. So far, they are only being added to dog food as part of testing, but nothing seems to be stopping them from spreading to human medicine and diet therapy.

The theory of antagonistic pleiotropy - characterises conditions in which certain genes confer benefits on the carrier in youth and reproduction but harm the carrier later in life. Ex: Huntington's chorea - AD disease (there are two theories, according to one the affected have psychological promiscuity as one of the manifestations = more children, according to the other the incidence of cancer among the affected is lower than among the same age in the normal population); haemochromatosis - AR disease (increased Fe deposition - advantage against plague); sickle cell anaemia (heterozygote - advantage in malaria); hereditary thrombophilia (tendency to thrombosis - advantage in **faster stopping of bleeding in case of injury** or childbirth, disadvantage in long immobilisation).

Current opportunities to influence

Calorie restriction

Caloric restriction - **reducing the amount** of food while maintaining its biological quality. An example is given in an experiment on a mouse that lives an average of 28 months, but lives up to 47 months when food is restricted to 25%. Reducing the amount increases lifespan, reduces oxidative stress, the incidence of tumours and slows ageing. The mechanism of action could be based on slower metabolism and devoting more energy to maintenance. **IGF-1** (somatomedin C) and insulin signaling is reduced, while the activity of deacetylases = **sirtuins**, which act on histones and also suppress DNA transcription and recombination, is increased. The **CALERIE** project (**C**omprehensive **A**ssessment of **L**ong-term **E**ffects of **R**educing **I**ntake of **E**nergy) is currently investigating whether it works in humans.

Physical activity

Physical activity - stimulates biogenesis and mitochondrial renewal in muscles, adequate doses of oxidative stress increase resistance to major oxidative stresses by the mechanism "what doesn't kill you makes you stronger" - ROS production in muscles (Reactive Oxygen Species).

Diet composition

Dietary composition - a higher proportion of **fruit and vegetables** in the diet (0.5 kg/day) is associated with a lower risk of cardiovascular disease, diabetes and some cancers (lung, mouth, pharynx). The diet should be adequate, as obesity brings with it many problems and risks.

References

Related articles

- Antioxidant protection of the human body
- Aging organism
- Resveratrol
- ROS

Sources

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- Article Calorie restriction and life extension