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Sport and Vitamin C / Sport és a C-vitamin

ÖSSZEFOGLALÁS:

A belélegzett oxigént szervezetünk felhasználja a szerves vegyületek lebontásához, mely ezáltal az energiaszükségletünk fedezésére fordítódik. Azonban a belélegzett oxigén közel 10%-a nem vesz részt az imént leírt folyamatban, hanem reaktív oxigéngyökökké alakulva képes más molekulákkal kölcsönhatásba lépni, így szervezetünkben oxidatív stresszt indukálni. A magas C-vitamin-koncentráció képes csökkenteni az oxidatív stressz szintjét. Sport közben megnő a belélegzett oxigén mennyisége, mely növeli az oxidatív stressz kialakulásának lehetőségét, ezáltal sportolóknál különösen fontos, hogy növeljék a bevitt C-vitamin mennyiségét. A C-vitamin nem minősül gyógyszernek, így a többlet mennyisége nem jelent veszélyt szervezetünk számára.

ABSTRACT:

We inhale oxygen to produce energy by oxidizing our food. However, almost 10% of the inhaled oxygen is escaped that basic route, and start to oxidize our bodies. This phenomenon referred to as "oxidative stress". This, chemical stress, can be reduced, by higher Vitamin C concentration. Those who sport will inhale more oxygen and consequently, they have even higher "oxidative stress" and need substantially higher Vitamin C concentration. Since Vitamin C is not a drug, but only strengthening the human body, therefore, there is no danger if, for the sake of success, we take more Vitamin C, than, absolutely, necessary.

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We are inhaling air which us a mixture on oxygen *(O2)* and nitrogen *(N2)*. In nitrogen the electrons occur in pairs, therefore it is a closed electron shell, thus it is not very reactive so we exhale it. The oxygen molecule, however, has an open shall electron cloud, because the loosest two electrons are unpaired as indicate by the two arrows. *(Note that a closed electron shell could be symbolised by double arrows: ↑↓)*

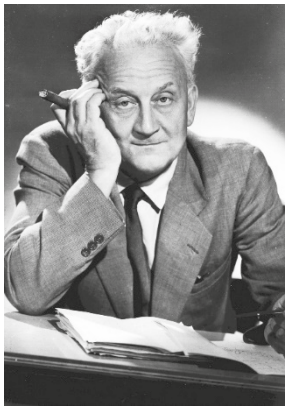
↑O=O↑

This means that the oxygen molecule is more reactive than the nitrogen molecule. Consequently, the human body is using O2 to oxidise the food, in order to produce energy of the body. The problem is that a relatively small amount *(less than 10%)* of the inhaled oxygen escapes from its normal route and it goes around in the human body and it oxidise randomly various portions *(like enzymes)* of the human body. This process is, usually, referred, to as "oxidative stress" *(Halliwell and Gutteridge, 2015)*.

The first problem that oxidative stress can cause is the weakening of the immune system. Later on, it could cause the development one or more of various diseases *(Valko et al., 2007)*. These could be:

Alzheimer
Parkinson
Diabetes
Cancer
Heart Diseases

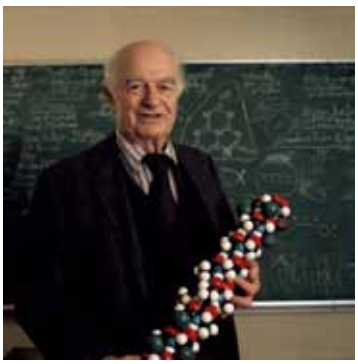
In the early 1930s, Albert Szent-Gyorgyi discovered that green pepper contains surprisingly large amount of Vitamin C. It has been realized, even before World-War-2, that Vitamin C is indeed "vital" *(Grzybowski and Pietrzak, 2013)*.



Prof. Albert Szent-Gyorgyi
(1893–1986)

According to historic gossips, the wife of Professor Szent-Gyorgyi was taking, daily 4000 mg of Vitamin C in order to preserve her beauty. Those who knew her personally declared that the experiment was successful.

In addition to the foregoing, the most interesting story was associated with Dr. Linus Pauling, who was a Chemistry Professor al Cal. Tech. *(California Institute of Technology)*.



Prof. Linus Pauling ***(1901–1994)***

After World War-II Szent-Gyorgyi professor migrated to USA then he and Professor Linus Pauling became good friends. From that point onward, Professor Linus Pauling became Vitamin C maniac. Not only did he take Vitamin C daily, but he tried to convince the American population that the best prescription against

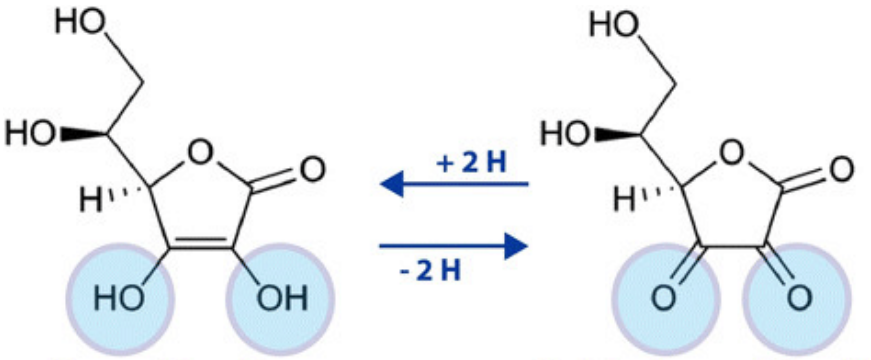
influenza virus is Vitamin C. Not because Vitamin C is a drug, but because it keeps the human body in a strong condition, so the body can fight against the virus effectively. In addition to this, he continued to increase his daily dose. Traditional medicine used to state that 100 mg is the daily requirement. Today we can buy tablets that contain either 500 or a1000 mg. In those days Professor Pauling went up to the level of 19 000 mg a day. People were screaming to him that it is dangerous, "with such a dose you will dye". Indeed he died, after his 93rd birthday.

Considering our daily problems of covid-19, we have a new dimension for Vitamin C. Today, the medical information states that the sign of corona virus infection is similar to influenza virus infection. If this is the case then we indeed should increase our Vitamin C level. That will make our bodies stronger to fight against the corona virus.

Now concerning our sport life, we must realise that we need more energy during sport activity. Therefore, we must oxidise more food. Consequently, we must inhale more oxygen. This implies that more oxygen molecule will escape in our bodies. Therefore, "oxidative stress" will be on the rise in our bodies. Clearly, the defence against this situation is the intake of higher daily dosage of Vitamin C *(Alessio et al., 1997)*. It is hard to predict what dosage to take because it depends on the intensity and the length of the training. On the day of training at least from 3000 to 5000 mg might be desirable depending on the length and the intensity of the training. Other days, perhaps the dosage could be 2000 mg/day *(i.e. 1000 mg in the morning and another 1000 mg at evening time)*.

We might emphasise that Vitamin C is a reducing agent, which is capable to transfer hydrogen *(H)* atom to oxidized molecule. For example, if we have hydrogen peroxide *(H-O-O-H)*, which is very dangerous to the human body, then Vitamin C can reduce it to water *(H2O)*.

$$H\text{-}O\text{-}O\text{-}H + 2H \rightarrow 2\ H_2O$$



The 2 hydrogen *(H)* atoms are donated by Vitamin C

There are numerous articles in the literature that deals with the question of Vitamin C in-take during sport activity *(Kawamura and Muraoka, 2018; Morrison et al. 2015; Thirupathi et al., 2021; Urso and Clarkson, 2003)*. Sometime, they suggest a gram *(i.e. a 1000 mg)* Vitamin C intake. In practice, it is desirable to take more, because at the center of oxidative stress, the actual redox-potential value may be considerably higher. The fundamental problem is that, there is no technology available today, to measure the voltage of redox-potential, anywhere, in the human body, even though in chemistry such technique is available nowadays.

When, at some future day we can measure the redox-potential anywhere in the human body *(like in the lungs or liver or prostate)* then we could notice that cancer has started at a particular point in the human body. At that time, we could determine what concentration of Vitamin C would reduce the increasing oxidative strength during a physical exercise. Until that day, we can only guess the correct dosage and it is safer to use higher dosage than the minimum value is.

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