INFLUENCE OF VITAMIN E FOR THE HUMAN ORGANISM

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ABSTRACT

In the last 20-30 years, there has been an increased interest in antioxidant substances, especially natural synthesis. In addition, a deeper study of vitamins better reveals the biochemical and physiological aspects of the vital activity of the cell and extracellular matrix. The progression in science creates new flagogens that the human body has not encountered before. This leads to an increase in allergic reactions and chronic inflammation. Chronic inflammation itself can serve as a good soil for the formation of tumors. Vitamin E analyzed in this work has a strong antioxidant effect [5], anti-inflammatory effect [20-22], and antitumor effect [31]. Given such important properties of tocopherols and tocotrienols, it would be correct to say that a medical professional should have a clue about which products to find natural vitamin E, what it is needed for, and what diseases can be prevented by using supplements containing vitamin E.

Keywords*: vitamin E, tocopherol, tocotrienol, chronal ring, chylomicrons, lipids, receptors, lipoproteins, affinity, flagogen, alteration, exudation, proliferation, prostaglandins, leukotrienes, cytokines, interleukins.*

АННОТАЦИЯ

В последние 20-30 лет наблюдается повышенный интерес к антиоксидантным веществам, особенно природного синтеза. Кроме того, более глубокое изучение витаминов лучше раскрывает биохимические и физиологические аспекты жизнедеятельности клетки и внеклеточного матрикса. Прогресс в науке создает новые флагогены, с которыми человеческий организм раньше не сталкивался. Это приводит к усилению аллергических реакций и хроническому воспалению. Хроническое воспаление само по себе может служить хорошей почвой для образования опухолей. Проанализированный в данной работе витамин Е обладает выраженным антиоксидантным действием [5], противовоспалительным действием [20-22] и противоопухолевым действием [31]. Учитывая столь важные свойства

токоферолов и токотриенолов, правильно было бы сказать, что медицинский работник должен иметь представление о том, в каких продуктах содержится натуральный витамин Е, для чего он нужен и какие заболевания можно предотвратить с помощью добавок, содержащих витамин Е. .

Ключевые слова: *витамин Е, токоферол, токотриенол, хрональное кольцо, хиломикроны, липиды, рецепторы, липопротеины, аффинность, флагоген, альтерация, экссудация, пролиферация, простагландины, лейкотриены, цитокины, интерлейкины.*

Classification of Vitamin E

Vitamin E is a lipophilic substance. The vitamin E group includes 8 molecules α-, β-, γ-, δ-tocopherol (α, βT, γT, δT) and α-, β-, γ-, δ-tocotrienol (aTE, βTE, uTE, δTE). All forms of vitamin E have a chromium ring and a 16-carbon chain. Tocopherols are saturated, and tocotrienols have three double bonds. Similarly, the fifth or seventh position of the chromanol ring by either group -H or group -CH 3, distinguishes tocopherols and tocotrienols. . Natural tocopherols have an RRR configuration in the 2, 4' and 8' positions, and tocotrienols have an R configuration in the 2nd position.

Plants produce natural forms of vitamin E [1]. Plant seeds like nuts are a rich source of aT and yT. Widely used sunflower seeds in the form of seeds or oil, almonds, peanuts contain a lot of aT, and products such as walnuts, pistachios and sesame seeds contain yT [2, 3]. A sufficient amount of δT is contained in tomato seeds, rice germ and soybean oil [6]. Tocotrienols relative to tocopherols are much less common in nuts; they can be obtained from palm oil, barley and some cereals [3, 4]

The various isoforms of vitamin E in our body are not equally distributed. It was found that the concentration of aT in plasma in people who do not receive additional vitamin complexes ranges from 20-30 microns, whereas yT can be 5-10 times lower than aT in blood [5]. This difference is due to the different affinity (affinity) between vitamin E isoforms and protein transporters or enzymes of tocopherols and tocotrienols.

Vitamin E Metabolism

Getting into the small intestine with food, tocopherols and tocotrienols are absorbed together with lipids and are part of chylomicron particles together with triacylglyrins, phospholipids, fatty acids, cholesterol and other fat-soluble substances [5, 6, 7]. By binding to chylomicrons through the lymphatic system, vitamin E is

delivered to all tissues and organs, in particular muscles, bone marrow, adipose tissue, skin and brain. Transport between tissues and the chylomicron most likely affects lipoprotein receptors, but these mechanisms are currently insufficiently studied [5, 6, 7]. It is interesting to note that in these tissues the concentration of yT. Higher than aT. The unabsorbed remnants of vitamin E are delivered together with other molecules in the composition of chylomicron to the liver and are absorbed there.

In the liver, aT binds to the α-TTP transporter protein. α-TTP together with the ATP-binding cassette transporter A1 (ABCA1) [8] and includes aT with lipoproteins [5]. The α-TTP carrier protein has 100% affinity for A T, 50% for a T, 1-30% for yT and δT. The carrier protein also protects various forms of vitamin E from catabolism in the liver. So the aT is protected from enzymes by 100%, because of its 100 binding to the protein. Other non-alpha forms in the liver are hydroxylated and oxidized by cytochrome P450, and at the second stage, the β-oxidation reaction of the wick chain to 13'-hydroxychromanol occurs, but with a high intake of vitamin E, the final metabolite may change.

Regulation of vitamin E metabolism

According to the works of Manor D. and Morley S. [8], it becomes clear that the main role in the regulation of metabolism belongs to the protein transporter α-TTF and ω-hydroxylase of vitamin E. These proteins can be said to have antagonistic properties. Thus, α-TTF prevents catabolism of various isoforms, and ω-hydroxylase, on the contrary, promotes catabolism of unrelated forms of vitamin E, showing the strongest activity to non-alpha forms than alpha. Due to these two opposite interactions, aT is predominantly accumulated in the tissues of the body, whereas yT and other forms of vitamin E are predominantly metabolized to hydroxycarboxychromanol, carboxychromanols and their conjugated analogues. It is also necessary to mention the proteins controlling absorption and excretion play an important role in bioavailability [9].

As it became clear from the facts stated, α-TTF is the main reason for the difference in the concentration of α-, β-, γ-, δ-tocopherols and α-, β-, γ-, δ-tocotrienols. But in the course of studies on mice and fruit flies without TTR, differences in concentrations still persisted (a higher level of aT than yT in tissues) [10,11]. These observations suggested that enzymes of various forms of vitamin E can also undergo selection of tocopherols and tocotrienols.

In addition to catabolism, another factor affecting the retention of these compounds in tissues is the excretion of vitamin E and its metabolites. Short-chain carboxychromanols and their sulfated or glucuronidated analogues are excreted in the

urine, while unconjugated carboxychromanols are mainly found in feces [12, 13]. The work of Bardowelli et al. Published in The Journal Biological Chemistry, it was found that approximately 80% of tocopherols and tocotrienols (metabolites) are excreted in the faeces. Unchanged tocopherols and tocotrienols are also excreted with bile (in the small intestine and feces).

Antioxidant activity

All isoforms of vitamin E have a powerful antioxidant effect, due to the ability to remove lipid hydroperoxyl radicals, giving hydrogen from the phenolic group of the chromal ring. Due to the presence of the phenolic ring, it is believed that all forms of vitamin E have high antioxidant activity [5]. After a number of studies in 2001 and 2012, it was found that tocotrienols perform better as an antioxidant than aT. This is attributed to the fact that tocotrienols are more evenly distributed on the lipid bilayer (phospholipid of the cell membrane) which gives a more effective interaction with hydroperoxyl radicals than tocopherols [14, 15].

In addition to donating hydrogen, natural forms of vitamin E have another way of disinfecting active forms of nitrogen. Therefore, yT has an unplaced position of 5 on the chrome ring. In inflammatory reactions, the NO2 formed in large quantities is attached to this place forming 5-nitro-yT. But it should be borne in mind that such a manifestation of antioxidant activity can be achieved only with the help of an unsubstituted part on the chromal ring, and isoforms having a methyl group (aT) in the 5 position are not capable of such [5,16,17,18]. It can be confirmed by experiments when an increase in 5-nitro-uT was observed during the induction of peritonitis [17] and occlusive thrombus in rats [18].

In addition, in comparison with aT, δT and δTE have higher antioxidant activity preventing lipid peroxidation in vitro. Based on these statements, it is logical to assume that aT is less active than its analogues [19].

Anti-inflammatory and antitumor mechanisms of vitamin E

Chronic inflammation is the cause of hyperreactivity to any flagogen. Such diseases can worsen the general well-being of the patient, can have serious consequences on the cardiovascular system and be a carcinogenic factor (development of tumors) [20, 21, 22]. Inflammation is the result of the body's response to any damage. During alteration, exudation and proliferation, a huge amount of substances (inflammatory mediators) are synthesized, such as reactive oxygen/nitrogen species, prostaglandins, leukotrienes, cytokines, interleukins, etc. which, with strong inflammatory reactions, can even damage the tissues of the host itself [23,24].

Studies have shown that certain forms of vitamin E, such as yT, δT and tocotrienols (especially yTE), have anti-inflammatory effects by inhibiting COX-2 and 5-LOX (arachidonate 5-lipoxygenase). There is also evidence that some JAK-STAT6 and JAK-STAT3 signaling pathways in various cell types can also be blocked. In addition, it has been shown that modified forms of vitamin E are more active in terms of inhibition of inflammation [9].

Animal experiments in clinical models have confirmed the beneficial effect of yT and other forms of vitamin E in pathological conditions associated with inflammation and oxidative stress. Thus, such moments as the protection of the lungs from damage to their own aggression factors, protection from oncogenesis and colitis were studied. In some experiments, there may be contradictory results, which may be associated with a different route of administration of drugs with vitamin E [25].

A large number of studies aimed at revealing the essence of carcinogenesis have shown that inflammatory bowel diseases can dramatically increase the risk of oncogenesis in this organ [26]. It became known that eicosanoids, COX and 5-LOX contribute to the development of cancer [27,28,29,30]. Due to its high antioxidant and anti-inflammatory properties, preparations containing vitamin E have been proposed as potentially useful chemoprophylactic agents against cancer. A paper published in 2009 in the journal Cancer Prevention Research suggested prescribing medications with a high content of all isoforms of vitamin E, especially those rich in yT, as drug therapy [31]. The following results were presented as evidence: suppression of inflammation and oncogenesis of the colon induced by azoxymethane and sodium dextrasulfate in mice, representing an experimental model of colon cancer caused by colitis [31]; and the experiments of Jiang et al. It has been shown that drugs with a high content of yT reduce the risk of oncogenesis of moderate colitis (caused after one cycle of sodium dextrasulfate administration), but not severe (more cycles of concerogen administration). In addition to colon cancer, Sanchez et al. It has been reported that a diet enriched with yT reduces the risk of dysplasia and hyperplasia of the prostate epithelium.

The anti-inflammatory effect of not only tocopherols, but also tocotrinols has been demonstrated in various disease models. Thus, in the Journal of Agricultural and Food Chemistry 2010 issue, it was shown that under the action of yTE, but not aT, inhibit the formation of prostaglandins E2 and cytokines under the action of UV-B. This is achieved by blocking the pro-inflammatory transmission of keratinocytes and induction of COX-2. It has also been shown in experiments on mice that tocotrienols enhance lymphocyte proliferation. In CD2F1 mice, subcutaneous injection of δTE

dramatically reduced radiation-induced mortality and promoted bone marrow and stem cell regeneration. Such a protective effect is most likely associated with the activation of kinase associated with extracellular signals. Tsuduki and sovt. Reported in their papers that foods rich in yTE reduce the clinical manifestations of allergic dermatitis in mice by suppressing degranulation and histamine secretion in mast cells. Palm oil rich in tocotrienol also softens the course of chronic pancreatitis, protects kidney damage associated with potassium dichromate. Radhakrishnan and sovt. In their studies, they confirmed the effect of aT, δTE and mixed tocotrienols on the immunization of mice against tetanus toxoid. These isoforms of vitamin E are able to enhance the production of antibodies against the toxin.

CONCLUSION

According to the International Agency for Research on Cancer in 2020-2021, the number of new cases of cancer increased to 19.3 million people, and mortality among them to 10 million. Such high rates can be associated with a serious blow to countries and citizens due to the pandemic, which may have led to a decline in the quality of life. In addition, with an increase for waste. Nevertheless, the fact remains not nominal. The growth of cancer is observed all over the world. Based on this, doctors, medical students and other medical professionals should promote a healthy lifestyle. In particular, everyone should know about which products contain certain useful substances in what quantity, and how they can be useful. The evidence presented in this review indicates that in experiments, dietary changes, i.e. the use of more tocopherols and tocotrienols reduces the high reactivity of the body and further blocks the carcinogenic effect of inflammatory reactions in the human body.

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