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Research Article

The Effects of Lycopene on Health and Fields of Use

Halil İbrahim Binici* and Adem Savaş[2]

[1] *Department of Nutrition and Dietetics, Faculty of Health Sciences, İstanbul Esenyurt, Türkiye*
[2]*Hazelnut Specialisation Coordination Office, Giresun of University, Giresun, Türkiye.*

Email of the corresponding author: (halilibrahimbinici@esenyurt.edu.tr)

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Abstract – In recent years, there has been increase in the interest of the general public in both healthy and functional foods. Because this interest is very important in terms of the fact that foods cause the prevention and emergence of many diseases. In this context, people there is a greater interest in fruits and vegetables in terms of adequate and balanced nutrition. This food group, which is richer than other foods, especially in terms of micronutrients, contains various phytochemicals such as phenolic compounds and antioxidants. As a matter of fact, antioxidants are defined as chemical compounds that can inhibit the oxidation process by preventing the initiation and progression of oxidising chain reactions. One of the phytochemicals and antioxidants is lycopene, which belongs to the carotenoid group. Acting as a natural pigment, lycopene has many functional properties (such as colouring, functioning of photosynthetic mechanisms) for plants. Lycopene, with the chemical formula $C_{40}H_{56}$, has a molecular mass of 536.89 Da. Lycopene, which has a hydrophobic structure, is soluble in various organic solvents. On the other hand, it is stated that it is extremely sensitive to elements such as oxygen, light, heat and moisture due to its structural properties. The most important sources of lycopene found in many fruits and vegetables include tomatoes, watermelon, pink guava, carrot, pumpkin, papaya and sweet potato. It is also stated that lycopene, which can have many positive effects on human health, has protective effects in terms of cancer, heart disease, aging, bone and skin health. It is also an important antioxidant compound in the elimination of free radicals that can occur as a result of many factors. Conversely, ingestion of foods or supplements containing excessive lycopene may result in the development of a condition known as lycopeneemia. This review article presents an overview of the chemical structure, properties and effects of lycopene on human health.

Keywords – Food, Fruits, Vegetables, Health, Lycopene

I. INTRODUCTION

Fruit and vegetables are an important part of the human nutrition. These foods are rich sources of vitamins, minerals, fibre and a variety of phytochemicals. Because of their rich composition, fruits and vegetables play an important role in the development and prevention of many diseases. In addition, fruits and vegetables show their beneficial effects through various mechanisms. Many health authorities and the World Health Organisation (WHO) promote the consumption of fruit and vegetables and recommend a daily intake of more than 400 grams per person [1], [2], [3].

Fruits and vegetables contain many phytochemicals. Phytochemicals are known to have many functional properties such as antioxidants, anticarcinogens and immunomodulators. Important phytochemicals include ascorbic acid, folate, carotenoids, phenolics, phenolic acids, tannins, monoterpenes, isoprenoids and organosulphur compounds. [1].

One of the important phytochemicals that has come under scrutiny in recent years is carotenoids. This group of phytochemicals is defined as a pigmented compound synthesised by plants and microorganisms. Carotenoids have many functional properties for plants and are responsible for the formation of yellow, orange and red colours. In addition to being an important source of antioxidants, caratenoids are thought to contribute to the prevention of various diseases [2]. More than 600 carotenoids have been identified in nature. However, about 90% of the carotenoids found in food and the human body are β-carotene, α-carotene, lycopene, lutein and cryptoxanthin [2], [4].

Lycopene, a member of the caratenoid family, is defined as an open straight-chain hydrocarbon synthesised by many plants and microorganisms. It also has a highly unsaturated structure consisting of 11 conjugated and 2 unconjugated double bonds. The chemical structure of lycopene is given in Figure 1. [2], [5].

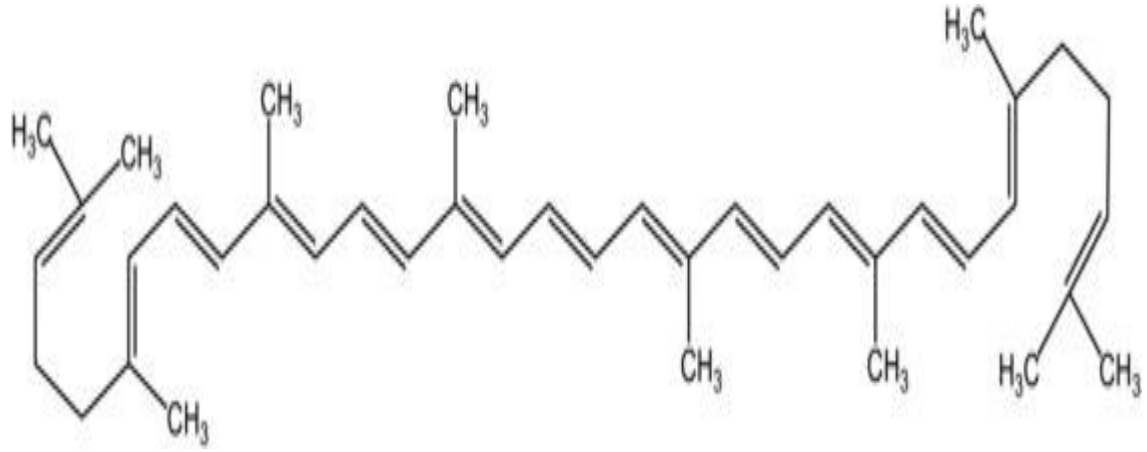

Fig. 1. The chemical structure of lycopene

The lycopene, with the chemical formula $C_{40}H_{56}$, has a molecular mass of 536.89 Da. Lycopene, which has a hydrophobic structure, is soluble in various organic solvents. On the other hand, it is stated that it is sensitive to many factors (such as oxygen, light, heat and humidity) due to its structural properties. The most important sources of lycopene found in many fruits and vegetables include tomatoes, watermelon, pink guava, carrot, pumpkin, papaya and sweet potato. In addition to processed tomato products, products such as ketchup and tomato paste stand out as important sources of lycopene [5], [6], [7], [8]. Natural sources of lycopene are presented in Figure 2.

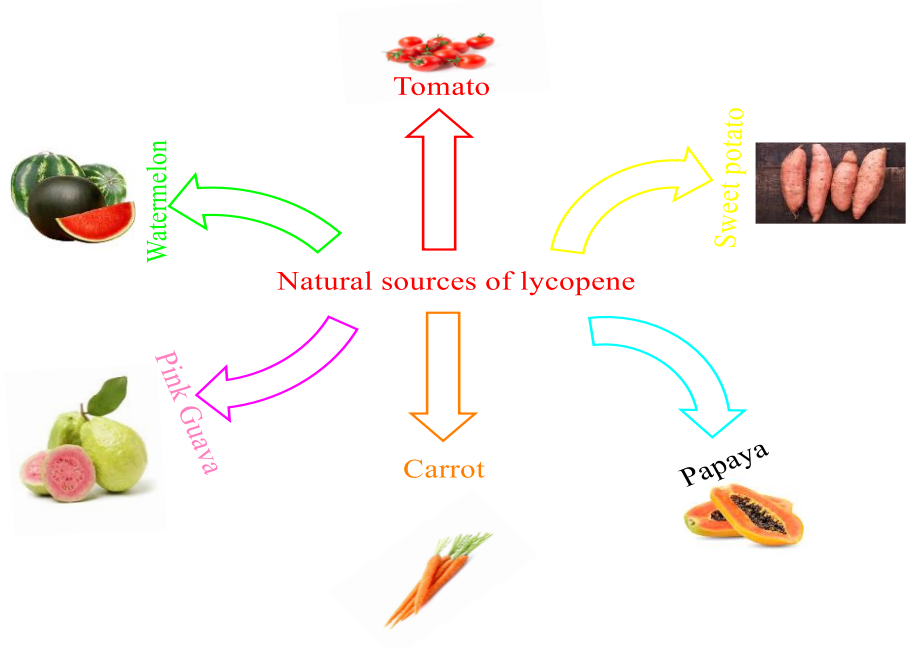

Fig 2. Natural lycopene sources

Today's society is increasingly interested in healthier and functional foods. Fruits and vegetables are among the most popular foods because of their high nutritional value. In fact, health authorities say that we should include more fruit and vegetables in our daily diets.

Antioxidants are defined as a substance that directly scavenges ROS or inhibits ROS production. In other words, antioxidants are defined as chemical compounds that can inhibit the oxidation process by preventing the initiation and progression of oxidising chain reactions. Antioxidants play a vital role in both food systems and the human body [9], [10]. One of the phytochemicals and antioxidants is lycopene, which belongs to the carotenoid group. Lycopene is a powerful antioxidant against oxidation of proteins, lipids and DNA, in addition, it is stated that it can also act on other free radicals such as hydrogen peroxide, nitrogen dioxide and hydroxyl radicals [8]. Lycopene is widely found in many fruit and vegetable products, especially tomatoes [5]. Lycopene has many effects on human health. Epidemiological studies reveal an inverse relationship between dietary intake of lycopene and the risk of developing some types of cancer. In their study, Şahin et al. (2018) reported that dietary intake of lycopene was associated with a reduced risk of ovarian cancer, which has chemopreventive potential against ovarian carcinogenesis [11]. It is also stated that lycopene prevents cardiovascular diseases and many cancers and has tumour growth retarding effects [8], [12], [13], [14].

On the other hand, carotenoderma with lycopenemia may occur very rarely due to excessive consumption of lycopene-rich foods. Tanaka et al (15) reported a relatively rare case of carotenoderma due to lycopenemia caused by excessive consumption of lycopene-rich vegetables and fruits.

II. CONCLUSION

Human beings need food to maintain their vital functions. Fruit and vegetables, one of the basic elements of the diet, contain phenolic compounds, antioxidants and various phytochemicals. These compounds not only increase the nutritional value and functionality of fruits and vegetables, but also have many positive effects on human health. However, it is well known that food needs to be ingested in sufficient and balanced amounts. This review focuses on the general structure, properties and health effects of lycopene, a member of the carotenoids.

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