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LYCOPENE AND ITS ANTIOXIDANT PROPERTIES IN THE PREVENTION OF CHRONIC ILLNESSES AND CANCER

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Abstract

Free oxygen radicals play important roles in the pathogenesis of some chronic diseases such as: diabetes, cardiovascular, neurological and cancer. The role of oxidative stress induced by reactive oxygen species (ROS) and the oxidative damage of important bimolecular are the main focuses of research related to chronic diseases. Antioxidants are known as potential scavengers of free radicals. If the balance between free radicals and antioxidants is destroyed, then the imbalance can lead to damage to DNA, lipids and proteins, which causes chronic appropriate body. The most powerful antioxidant in the carotenoid group is lycopene. According to the given literary values, the daily dose of lycopene in the prevention of chronic diseases and cancer is 60 mg. The aim of our research was to determine the content of lycopene in certain varieties of fresh tomatoes, the benefits of its antioxidant properties and the role in the prevention of chronic diseases and cancer.

In our country in terms of cultivation and consumption of tomatoes and tomato products, we can say that the tomato is the most important natural source of lycopene. The tested material that we used and to which we determined the content of lycopene were the following varieties of fresh tomatoes: Arizona (9.37 mg/100 g), Aleksandar (10.44 mg/100 g), Rio Grande (9.80 mg/100 g), Florida (10.73 mg/100 g), Peak rape (9.67 mg/100 g), Carioca (9.75 mg/100 g), Heinz 7151 (11.02 mg/100 g), and Vf 10 (11.51 mg/100 g). The lycopene was isolated by column chromatography of the extract obtained by refluxing of tomato paste.

From the results obtained it can be concluded that each variety of tomatoes has different lycopene content. With the highest content of lycopene of 11.51 mg/100 g the fruits of tomatoes of the variety Vf 10 were distinguished, and the smallest content of 9.37 mg/100 g was found the fruit of tomatoes from the Arizona variety.

Also this scientific study will allow nutritionists to use these values for different varieties of tomatoes in order to recommend a daily dose of lycopene.

***Key words**: Lycopene, Antioxidant, Tomato, Health effects.*

1. Introduction

Antioxidants are natural or synthetic molecules that even in low concentrations can prevent or reduce the extent of oxidative damage caused by free radicals [1]. Free oxygen radicals play important roles in the pathogenesis of several chronic disorders such as cancer, diabetes, and cardiovascular and neurologic diseases [2].

Antioxidants are known as potential scavengers of reactive oxygen species (ROS) that protect biologic membranes against oxidative damage. If the balance between free radicals and antioxidant defense is destroyed by chemicals, the imbalance may lead to damage to DNA, lipids, and proteins [3]. The role of oxidative stress induced by ROS and the oxidative damage of important biomolecules are the main focuses of research related to human diseases [4].

Lycopene is the most potent antioxidant among various common carotenoids [5]. It is one of the most representative carotenoids naturally found in plants,

bacteria, fungi, and algae [6]. This class of phytochemicals has recently attracted much attention due to potential health beneficial effects associated with carotenoid intake and food rich in carotenoids. Lycopene is a fat soluble pigment synthesized by plants and microorganisms and is responsible for the red colour to vegetables and fruits. The main natural source can be considered tomato and tomato products. It is considered as one of the most effective single oxygen species in carotenoids and its in activation capacity is twice that of beta carotene and 100 times that of vitamin E [7]. As reported in various studies, lycopene is known as the most powerful antioxidant among major carotenoids detected in human tissues or blood [8], and it may have a inhibitory effect on cholesterol synthesis which may enhance the light density lipoprotein (LDL) degradation [9, 10].

In general, carotenoids play a very important role as scavengers of free radicals in humans [11]. Cardiovascular disease (CVD) and cancer is a major cause of mortality in Western countries [12, 13]. From this point of view, it is important to set up new strategies to fight this kind of disorders and the use of bioactive compounds or nutraceuticals could be useful for this scope. In fact, several clinical and epidemiological studies have confirmed that diets rich in lycopene are associated with the prevention or reduction of the risk of CVD [14], reduced risk of developing prostate lung and ovary cancers and with a lower incidence of chronic diseases [15, 16 and 17]. It is interesting to note that some more recent studies indicated that lycopene intake present in tomato fruit is more effective in preventing certain types of cancer than the of purified lycopene by capsules [18].

The aim of our research was to determine the content of lycopene in the following varieties of fresh tomatoes: Arizona, Alexander, Rio Grande, Florida, Peak Rape, Carioca, Heinz 7151 and Vf 10. Knowing its content in the examined varieties of fresh tomatoes, we will also know the daily intake of lycopene in the body and the benefits of its antioxidant properties and the role in the prevention of chronic diseases and cancer.

2. Materials and Methods

2.1 Materials

For this scientific paper as a material we used fresh fruits of tomatoes from the following varieties: Arizona, Aleksandar, Rio Grande, Florida, Peak rape, Carioca, Heinz 7151 and Vf 10.

Arizona, Rio Grande, Carioca, Heinz 7151, and Vf 10 are industrial varieties of tomatoes, while the Aleksandar, Florida and Peak rape are varieties for fresh consumption.

These varieties of tomatoes were grown in the southwestern part of the Republic of Macedonia in 2018. The tomato fruits are harvested in technological maturity.

2.2 Methods

Fruits size and weight are an important feature not only for the outer appearance, but also from the aspect of the fruits quality [19 - 24]. The average weight of tomato fruits is determined by measuring it on analytical scale "Mettler" with an accuracy of ± 0.01 g. Measurement is done on 50 fruits of each tomato variety.

Lycopene is isolated by column chromatography of the extract obtained by refluxing on tomato pasta. The resulting lycopene had a purity of 96%. Intense color of the resulting fractions during elution of the preparatory column enables identification of the present pigments by means of absorption spectroscopy. For determining the content of lycopene in samples of fresh tomatoes fruits, a spectrophotometric method was applied [19].

A sample of fresh tomatoes was homogenized. In 0.6 g from the fresh tomato homogenized sample were added: 10 mL of hexane, 5 mL of acetone, and 5 mL of ethanol (2 : 1 : 1). Mixture was placed in a frosty bath, and mixed on a magnetic stirrer for 15 minutes. Then 3 mL of distilled water was added, and stirred for another 5 min. The sample was left at room temperature for 5 min. in order different layers to be separated from each other. Absorbance of the upper hexan layer of the tomato extract in a quartz sill with a thickness of 1 cm^3 is measured, at a wavelength of 503 nm (Jenway 6305 UV / Vis spectrophotometer) in relation to a blank sample hexane. Then in each sample the content of lycopene is determined.[24-26] [24 - 26].

3. Results and Discussion

The average weights of eight varieties of tomatoes are given on Figure 1.

During the research fruits of the tomato variety Florida achieved the highest average weight of 316.63 g and variety Vf 10 fruit tomato had the lowest average weight of 69.51 g.

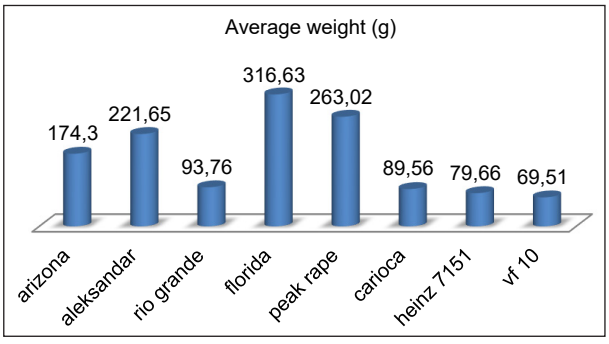

Figure 1. Average weight of the tomato fruits

Results of our trials for the average weight of the fruits of the eight varieties of tomatoes, compared to the examinations of other authors, are in the interval of the expected values. The differences are the result of different varieties of tomatoes [19 - 24].

Content of average lycopene levels in: Arizona, Aleksandar, Rio Grande, Florida, Peak rape, Carioca, Heinz 7151 and Vf 10 are: 9.37, 10.44, 9.80, 10.73, 9.67, 9.75, 11.02, and 11.51 mg/100 g respectively (Figure 2).

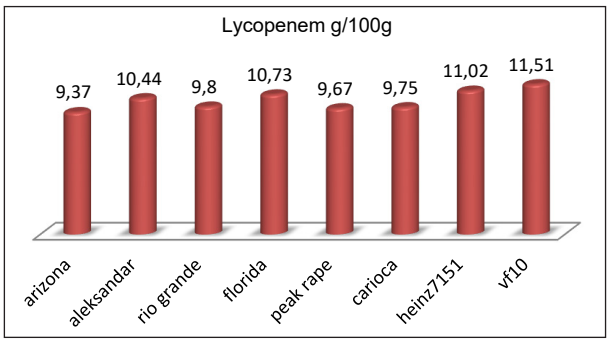

Figure 2. Content of lycopene in the tomato fruits

From obtained results it can be concluded that each variety of tomatoes has different lycopene content. The highest content of lycopene of 11.51 mg/100 g, was found in tomato fruits of the variety Vf 10, and the smallest content of 9.37 mg/100 g in the of tomato fruits from the Arizona variety. Vf 10 cultivar physically has a deeper red color compared with the other varieties which is in agreement with these results.

The results of our trials, for the content of lycopene of the fruits of the eight varieties of tomatoes, compared to the examinations of the quoted authors, are in the interval of the obtained values. The differences are the result of different varieties of tomatoes [20 - 30].

4. Conclusions

- From the results obtained, it can be concluded that each of the examined varieties of fresh tomatoes (Arizona, Alexander, Rio Grande, Florida, Pick Rape, Carioca, Heinz 7151 and Vf 10) has a different content of lycopene which ranges from 9.37 mg/100 g to 11.51 mg/100 g and meet the daily intake of lycopene in the human body.

- Knowing the benefits of antioxidant properties and the role of lycopene in curing chronic diseases and cancer, a great source of lycopene are the examined varieties of fresh tomatoes.

- This research will allow nutritionists to use these values for the examined varieties of fresh tomatoes in order to recommend a daily dose of lycopene.

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