

NUTRITIONAL AND CHEMICAL CHARACTERIZATION OF SOME LOCAL TOMATOES (*SOLANUM LYCOPERSICUM*) ASSORTMENTS

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Abstract. *The aim of the present paper was to evaluate biochemical and nutritional characteristics of tomato varieties grown in the Gorj and Timis counties (the content of dry matter, ascorbic acid). A diet rich in fruits and vegetables (high in bioactive compounds) is correlated with a decreased risk of many degenerative diseases (such as cancer and cardiovascular disease) as well as related to lifestyle and aging diseases. Tomatoes (*Solanum Lycopersicum*) are fruits rich in bioactive substances, especially compounds with antioxidant character. The activity of these bioactive compounds is to combat the activity of free radicals (which are responsible for oxidative stress). Tomatoes are the most popular vegetable crop in the world. These vegetables are important due to their high contribution to human health and nutrition. The attractive color and flavor of tomato have made it a dietary staple in many parts of the world. Tomatoes and tomato products are rich in antioxidants, being a source of carotenoids, especially lycopene and phenolic compounds. Rich levels of ascorbic acid (vitamin C) in tomato fruits provide health benefits for humans and also play an important role in some aspects of plant life. In this work, we investigated differences in moisture (water content), total dry matter, ash (total mineral content), and content in ascorbic acid (a bioactive constituent) of fruits of different tomato varieties grown in the Gorj and Timis counties collected from local farms during the first harvest.*

Keywords: *tomato, bioactive compound, ascorbic acid, mineral content*

INTRODUCTION

Romania is a European country with a rich diversity of plants due to climatic conditions and geographical position (in South East of the continent). A vast variety of fruits and vegetables provide a significant amount of nutrients and bioactive components with health benefits beyond basic nutrition (LIU, 2013). Tomato is one the most important vegetable in the world after potatoes. (TORBICA *et al*, 2016; FAOSTAT, 2019). This fruit is very common in the Romanian diet and is one of the most consumed vegetables as fresh as the processing industry.

This horticultural plant is an excellent source of important health compounds due to its balanced content of minerals and antioxidants (e.g. : vitamins C and E, carotenoids, lutein, lycopene, phenolic compounds, and phenolic acid, and flavonoids) (KURINA *et al.*, 2021). The nutraceutical value of tomato fruit is offered by the content of compounds carotenoids, polyphenols, organic acids, soluble sugars, minerals and vitamins (especially vitamin C and E). (RAIOLA *et al.*, 2015; MARTÍ *et al.*, 2016), and also volatile compounds (WANG, SEYMOUR, 2017; KURINA *et al.*, 2021)

In the present work, it was determined the physicochemical composition of tomato fruits. The aim of this research has been accomplished to emphasize the correlation between the chemical content, antioxidant character (the ascorbic acid content– vitamin C), and nutritional values of the tomato species grown in Romania.

MATERIAL AND METHODS

Chemicals and equipment. All reagents used in this research were of analytical grade – from SigmaAldrich and Merck (Germany).

Collection and samples preparation. The fruits of tomatoes were collected randomly from the Timis and Gorj counties in during the first harvest, in summer or autumn season of 2017. All the fruits were picked at the ripe stage, arrived to the laboratory (less than 24h after harvesting). These five common tomato varieties are grown in rural areas in Gorj and Timiș counties (Romania). The collection of tomato fruits was undertaken according to the characteristics of morphological and sensory that confer their use, these characteristics are defined by the information given in Table 1.

The tomato variety was long tomato (GV5), round tomato (TV2, TV3, GV4), and heart tomato (GV1), orange-red tomato (GV5). Cultivar GV1, GV4 and GV5 were from Gorj county, and cultivar TV2, TV3 are from Timiș county. The preparation of the samples consisted of removing solid impurities on the fruit by washing the fruit under running tap water and gently drying them using absorbent paper. The tomato fruit was sorted according to color and shape (as uniform as possible), then stored (up to 1 month) in polyethylene bags at -20°C until analysis. The weight of fruit, total dry matter (weight) (TDM), and moisture were identified by using samples of fresh fruit immediately after their arrival at the laboratory.

For each cultivar, we have taken fruits from four plants, two fruits from each individual plant. We have taken into analysis five variety of tomatoes (*Solanum lycopersicum*). Thus, six fruits from each cultivar were used for analysis.

Determination of physicochemical properties

Fundamental nutritional parameters which we determined on the collected/ harvested fruits are the following: moisture (water content), total dry matter, and ash (total mineral content). (AOAC, 1995, 2002; POPESCU et al., 2018^a)

To determine the weight of the fruit, we used a digital scale with a sensitivity of 0.01 g. Each determination was performed three times (in triplicate). The weight of the fruit was measured in triplicate. Each replica was obtained from the fruit taken into the analysis (6 for each type). At first, the fruits were weighed individually to the fruits, then 2 and 3 fruits respectively and to all six. The result of each measurement was divided by the number of fruits placed on the scales.

Ascorbic acid determination. Determination of ascorbic acid content in tomato was accomplished by titration with 2,6-diclorophenolindophenol (2,6-DFI, reagent Tillmans). The method is based on the color change of the reagent, following the redox reaction. Thus, 2,6-diclorophenolindophenol in the ionized form is red in acid and blue in the basic medium.

Ascorbic acid was extracted using a weak acid (solution of 2% oxalic acid in the presence of hydrochloric acid) and titrated against solution using 2,6-diclorophenolindophenol solution until we observed a light pink-purple color (AOAC, 2002; POPESCU et al., 2018^{a,b})

Statistical analysis. Each determination was performed three times (in triplicate), then were calculated the arithmetic mean of these three separate determinations. For statistical analysis of the data were used the program Microsoft Excel.

RESULTS AND DISCUSSIONS

The morphologic characteristics and descriptions of tomato fruits

Table1 shows some morphologic characteristics and descriptions of five different tomato varieties (taken in our study) from Gorj and Timis counties. The morphologic characteristics and descriptions of analyzed tomato fruits are shapes, size of the fruit, seed number per fruit, the exterior color of mature fruit, and average fruit weight.

Table 1

Some morphologic characteristics and descriptions of five different tomato varieties from Romania

Cultivar (Abbreviation)	Predominant fruit shape	Fruit size	Fruit firmness	Seeds number	The exterior colour of mature fruit	Fruit weight (average), g
GV1	Heart-shaped	Intermediate (4–10 cm)	Firm	Small	Red -pink	310
TV2	High rounded - flattened -shape	Very large (>10 cm)	Intermediate	Small	Red	439
TV3	Rounded shaped	Small (2–5 cm)	Soft	Intermediate	Red	15
GV4	Rounded - flated shape	Intermediate (3–8 cm)	Firm-Intermediate	Hight	Red	72.1
GV5	Ellipsoid (plum-shaped)	Intermediate (3–6.cm)	Firm	Hight	Orange/red	49.1
Average of eight fruits from different plants						

Figure1 shows the average data of the weight of tomatoes considered in analyses. The differences in fruit weight are depended on the size of the fruit.

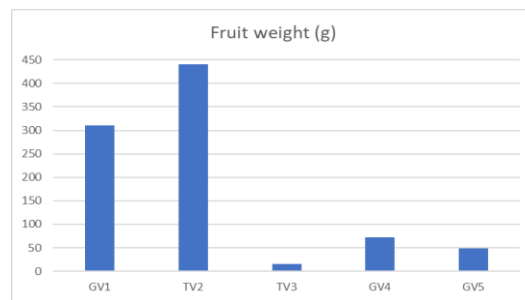


Fig. 1. The weight of the tomato fruits taken in the study

The weight of the analyzed tomato fruit ranged from 10 g to 539 g, the TV2 cultivar having the largest fruit. The weight of the fruit depends on the species, shape, region, and soil

The total dry weight content and moisture of the tomato fruits taken in the study are given in figure 2. The moisture content of tomato species varied between 82.02 and 96,2 g/100g FW (fresh weight- FW).

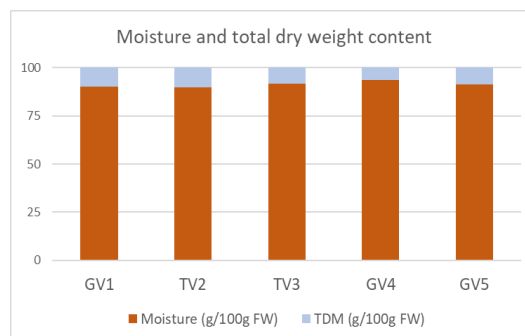


Fig. 2. The total dry weight content and moisture of the tomato fruits taken in the study

The highest moisture content (94.1 g/100g FW) was identified for rounded flated-shaped tomato with intermediate size (GV4). The lower moisture content (88.9 g/100g FW) was identified at TV2 cultivar with a very large size and rounded flatted shape.

From these data it can be concluded that tomato fruits (TV2) can be recommended for the production of fresh fruit, because this variety of tomato has an attractive fruit, and can be recommended for homemade and industrial processing, due to their high dry matter content (high TDM content).

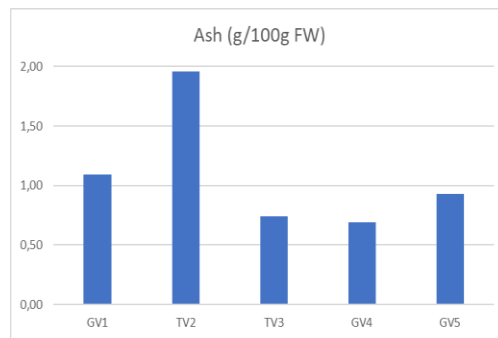


Fig. 3. The total mineral content (ash) of the tomato fruits taken in the study

The ash content (g/100g FW) is the indicator of the total mineral content as a criterion of quality that can offer information about the analyzed fruits' origin. The differences in the ash content of fruit could be due to the way of harvesting and conditions of storage. (KAUR and DAS, 2011; KURINA, 2021). As can be seen from figure 3, where is presented our data, the higher ash content (total mineral content) for the analyzed fruits was found in the tomato variety TV2 (1.99 %) and the lowest in the tomato variety GV4 (0.67%).

The ascorbic acid content in the fruit of the tomato cultivar was determined, and data obtained are shown in figure 4. To determine the ascorbic acid content, the titrimetric (with 2,6-DFI) method of tomato extracts was applied.

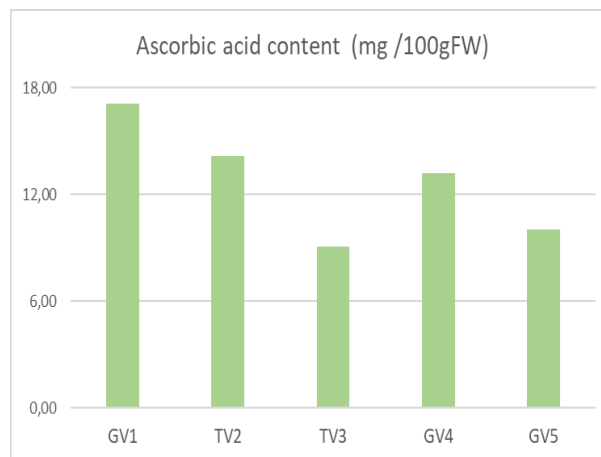


Fig. 4. The ascorbic acid content of the tomato fruits taken in the study

As can be seen from figure 4, the ascorbic acid content of analyzed tomato fruits were found to range between 9.01 mg /100g FW (TV3 variety) and 17.15 mg /100g FW (GV1 variety) – figure 4.

Ascorbic acid was in all the samples, and the sample so-called heart tomato (GV1) had the highest concentration (17.15 mg/100 g FW). The values found in our study were in concordance with the study of GEORGE et al., 2004 – vitamin C content varied from, 8 to 32 mg/100 g in the pulp and 8 to 56 mg/100 g in the skin of tomatoes grown in India. The content of ascorbic acid (AAc) found by the studies of Toor and Savage (2005) is ranged from 6 to 18 mg/100 g FW) and PINELA et al.(2012) found the AAc content between 10.85 and 18.56 mg/100 g FW in portuguese tomato varieties. But our data are lower than the values determined in tomatoes from Czech Republic (KOTKOV et al., 2011) and Spanish tomato (GUIL-GUERRERO and REBOLLOSO-FUENTES, 2009) – the values of AAc content is ranged 21.7 – 25.8 mg/100g FW, and respectively 39 – 63 mg/100 g FW. The ascorbic acid role in the prevention of diseases regarding oxidative damage occurs due to its capacity to neutralize the action of free radicals in biological systems. (BORGUINI AND TORRES, 2009). Ascorbic acid (vitamin C) is found in abundance in many fruits and is a hydrophilic antioxidant.

From our experimental data, in the tomato variety, there are differences regarding the vitamin C content. Noticeable differences in the ascorbic acid contents in tomato cultivars are closely correlated to genotype and to several factors – the ripening stage, climatic environment (especially light and temperature), and practices of cultivation (water availability, total mineral content - mineral nutrients) (DUMAS et al., 2003).

CONCLUSIONS

In our work, investigations of physicochemical characteristics were carried out to reveal the nutritional values, chemical composition, and antioxidant capacity (ascorbic acid content) of tomato species in Romania.

From our experimental data, in the tomato variety (grown in Romania), there are differences regarding the physicochemical characteristics – vitamin C content, fruit weight, and total mineral content (ash).

The tomato fruits can be recommended for the production of fresh-eating fruit, because they have an attractive fruit, and can be recommended for processing, due to their higher TDM content.

Tomato fruits are an important source of ascorbic acid, having beneficial effects on health. From our experimental data, in the tomato variety, there are differences regarding the vitamin C content.

The differences remarked in the ascorbic acid contents of tomato varieties are closed correlated to genotype and to several factors such as the ripening stage, climatic environment (especially light and temperature), and cultivation practices (water availability, mineral nutrients).

The present results lead us to conclude that tomato fruit is a possible candidate for the study of bioactivity as well as the functional development of fruit.

From these results, it can be noted that tomato fruits represent valuable products, due to their rich and beneficial nutritional composition and can be useful in a balanced diet. Furthermore, this work provides many arguments for the use of tomato fruits as healthy foods and their use not only in the food industry but also in the pharmaceutical industry.

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