ISSN: 2594 - 2905

PHYSICAL, CHEMICAL AND FUNCTIONAL CHARACTERIZATION OF CUATOMATE (*SOLANUM GLAUCESCENS ZUCC*) FRUIT AT TWO MATURITY STAGES.

PHYSICAL, CHEMICAL AND FUNCTIONAL CHARACTERIZATION OF CUATOMATE (SOLANUM GLAUCESCENS ZUCC) FRUIT AT TWO MATURITY STAGES

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https://doi.org/10.61117/ipsumtec.v7i2.327

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Abstract--The cuatomate is a highly valued fruit in the diet of the people of the Mixteca baja poblana. The present study was carried out to evaluate the physical, chemical and functional properties of cuatomate fruit (*Solanum glaucescens Zucc*) at two stages of maturity in order to estimate its nutritional and functional value. Weight, polar and equatorial diameter, pH, titratable acidity, moisture, protein, lipids, ash, crude fiber and carbohydrates were determined. The functional value was quantified by determining phenols, flavonoids and antiradical activity against the DPPH radical.
A completely randomized factorial design was used.
The results show a significant difference in weight (p= 0.025), fruits at green maturity stage presented higher weight, but not for polar and equatorial diameter and number of seeds.
Ripe fruits showed higher percentages of protein 4.733 %), fat (1.786 %), ash (5.403 %),
carbohydrates (1.939 %), acidity (0.0503 %) and TSS (1.566
°Brix), while in green fruits it presented higher percentages of crude fiber (4.447%) and pH (5.857).
There are significant differences in the functional properties due to the state of maturity between fruits, green cuatomates presented a higher content of phenols (418.57 ± 2.74 mg EAG/100 g of dry sample). In contrast, the flavonoid content for green cuatomate was lower (1162.3± 31.7 mg EQ/100 g of ms) than in mature stage of 2676.8 ± 6.78 mg EQ/100 g of ms. However, higher antiradical DPPH activity was found in green cuatomate, since only 12.883 ± 0.503 mg of green cuatomate was required to reduce 50% of the antiradical DPPH activity with respect to ripe cuatomates (97.450± 1.105mg). The results obtained indicate that cuatomate fruits provide significant nutritional and functional properties.
that can be used to enrich food and beverages.
Key words-- Solanum glaucescens, DPPH, Antiradical activity.

Abstract -- The cuatomate is a fruit highly appreciated in the diet of the residents of the Mixteca Baja region of Puebla. The present study was carried out with the objective of evaluating the physical, chemical and functional properties of the cuatomate fruit (Solanum glaucescens Zucc) in two stages of maturity to estimate its nutritional and functional value. Weight, polar and equatorial diameter, pH, titratable acidity, humidity, protein, lipids, ash, crude fiber and carbohydrates were determined. The functional value was quantified by determining phenols, flavonoids and antiradical activity against the DPPH radical.
A completely randomized factorial design was used.
The results show a significant difference in weight (p= 0.025), fruits in a state of green maturity presented greater weight, but not for polar, equatorial diameter and number of seeds.
Ripe fruits presented a higher percentage of protein (4.733%), fats (1.786%), ash (5.403%), carbohydrates (5.403%), and carbohydrates (1.786%).
(1.939%), acidity (0.0503%) and TSS (1.566),
while green fruits presented higher percentage in crude fiber (4.447%) and pH (5.857).
There are significant differences in the functional properties due to the state of maturity between the fruits, the green tomatoes had a higher content of phenols (418.57 ± 2.74 mg EAG/100 g of dry sample). On the other hand, the flavonoid content for green cuatomate was lower (1162.3± 31.7 mg EQ/100 g of ms) than in the mature state of 2676.8± 6.78 mg EQ/100 g of ms. However, greater DPPH antiradical activity was found in green cuatomate, since only 12,883 ± 0.503 mg of green

cutomate is required to reduce 50% of the DPPH antiradical activity with respect to mature cuatomates (97,450 ± 1,105mg). The results obtained indicate that cuatomate fruits provide significant nutritional and functional properties that can be used to enrich foods and beverages.

Key words - Solanum glaucescens, DPPH, Antiradical activity.

INTRODUCTION

The lowland Mixtec region of Puebla has a semi-warm, sub-humid climate with some rainfall in summer and prolonged periods of drought with limited water availability, both for human consumption and for the development of agriculture; however, empirical peasant knowledge has allowed the inhabitants of this region to preserve the cultivation of wild species that are part of their diet such as cuatomate [1], which has a cultural, economic, gastronomic and agroecological value [2,3].

The cuatomate, *Solanum glaucescens Zucc*. belongs to Solanaceae family of the genus Solanum and subfamily Solanoidea, located in the Mixtec region of the states of Oaxaca, Puebla and Guerrero in Mexico [2,3,1]. It is a wild, perennial, semi-woody, climbing type plant.

[1] that grows on trees that provide support and shade, although it is possible to find fruits throughout the year, the highest production is concentrated in the months of June to September, when the rainy season occurs in this region [4,1].

The cualtomate fruit is collected mainly from wild plants located in hills and ravines, which are more prolific in fruit [4]; it is used for human consumption and its sale represents an economic income [5] for the inhabitants of the Mixtec region. It is considered a highly valued wild fruit whose demand has increased rapidly due to transportation, marketing and promotion by Mixtec migrants in the United States [1,5] and has led to the evaluation of practices for semi-intensive production [6,7], consisting of the extraction of seeds to be cultivated in home gardens. Although there are differences in the characteristics of fruits, leaves and stems of cuatomate plants, Mixtec farmers clearly identify only three types: green, white or ashy and mottled, which are related to the external color of the fruit from its early stages of development until the beginning of ripening (in which all types acquire a yellow-orange color) [2], as a consequence of the alteration of the chlorophyll content, carotenoids and accumulation of flavonoids. Being a climacteric fruit, its ripening process involves textural changes, modifications in the content of sugars, organic acids and volatile compounds that affect nutritional quality, flavor and aroma [8], so it is proposed that maturity stage affects the physical, chemical and functional properties of cuatomate fruits.

In its different stages of maturity it is highly appreciated in the regional gastronomy for its organoleptic characteristics (smell, texture and flavor) and integrated as an ingredient in diverse meals. The unripe cautomate has a firm pulp and is therefore included in various gastronomic dishes, especially in the preparation of sauces; this characteristic firmness is maintained during storage at room temperature, preserving its optimal physical, chemical, and sensory characteristics for up to 15 days [5].

Research on this fruit has focused mainly on ethnobotanical studies and agronomic characterization [7], domestication processes [6], traditional knowledge [1] and physicochemical and functional evaluation according to the harvest season [5]. Although these investigations highlight cuatomate as an important species for the producers of the Mixteca baja poblana due to its economic, social and ecological repercussions, as well as its food security due to its use, exchange and cultural values [4,1], there are currently no studies about their nutritional and functional composition during the phenological stages of the fruit in which they are frequently used in the preparation of food and that allow to know the contribution in the diet the Mixtecs, for this reason the objective of the present study was to evaluate the physical, chemical and functional properties of the cuatomate fruit (*Solanum glaucescens Zucc*.) at two stages of maturity to estimate its nutritional and functional value.

DEVELOPMENT

The present work was carried out in the Basic Multifunctional Laboratory of the Food Industry Engineering Career of the Tecnológico Nacional de México Campus Acatlán de Osorio.

Raw material procurement

The fruits of cuatomates (*Solanum glaucescens Zucc*) were obtained from orchards in the community of Santo Domingo Tonahuixtla belonging to San Jerónimo Xayacatlán, Puebla. The fruits from emergence to cutting were labeled (Figure 1) indicating the date of fruit emergence.

Figure 1. Cuatomate fruits selected for this study.
Source. Own elaboration, 2024

Sample preparation

The fruits were classified into six stages of maturity (Figure 2) according to the loss of green coloration and the appearance of orange colored zones, following what was published by Hernández-Rojas *et al* [4]. For this research, two stages of maturity were selected, green (EM1) when it reached the optimum size for consumption and orange (EM6), when chlorophyll has decreased and the amount of flavonoids and carotenoids has increased.

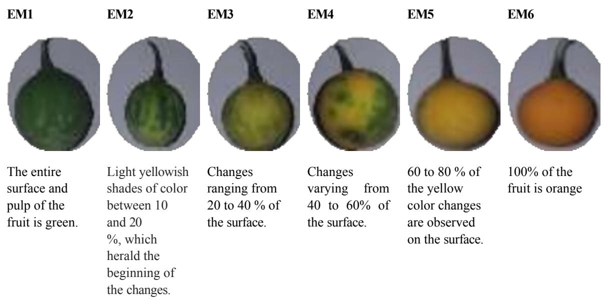


Figure 2. Maturity stages of cuatomate (Solanum glaucescens Zucc.) fruits.
Source: Own elaboration, 2023

Batches of 60 cuatomates in the EM1 and 60 in EM6 stages of maturation were selected; they were washed with potable water and immersed for 15 minutes in a 50 ppm solution of sodium hypochlorite to disinfect them, then dried with absorbent paper until excess solution eliminated. Once dried, they were stored in labeled zip lock bags until analysis.

Physical properties

Physical parameters such as weight, diameters (polar and equatorial) and number of seeds were determined for each lot.

Fruit weight: An OHAUS model AS200 analytical balance with an accuracy of ±0.0001 was used [4,9].

Polar and equatorial diameter: It was measured with a digital vernier, graduated Mitutoyo brand, in millimeters, measured from the base to the tip of the fruit (vertical) and the transverse contour of the fruit [4,10,9].

Number of seeds: Each fruit was cut in half and with the help of stainless steel tweezers the seeds were extracted and later counted [4].

Chemical properties

For each stage of maturity, three quatomates were taken at random and physicochemical parameters such as moisture, protein, ash, fat, crude fiber, carbohydrates, total soluble solids, titratable acidity and pH were determined in triplicate.

Moisture: Moisture content was determined in accordance with NMX-F-428-1982 [11] using a Velab thermobalance, model VE-50-5, at a temperature of 105 °C. The value obtained was recorded as a percentage of humidity.

Proteins: The total protein content was determined by the AOAC 2001.11 Official Method, with some modifications. The result was expressed as percentage of protein [5].

Ash: It was determined by the total ash method by calcination. The result was expressed as percentage ash.

Fats: Fat content was determined by the soxhlet method [5]. The result was expressed as fat percentage.

Crude fiber. The crude fiber methodology used was in accordance with that described in NMX-F-090- S-1978 [12]. The result was expressed as a percentage of crude fiber.

Determination of carbohydrates. It was determined by difference from the other components [13]. The result was expressed as percentage of total carbohydrates. **Total soluble solids (TSS)**: A quatomate was cut into small portions and ground together with 10 mL of distilled water and the mixture obtained was filtered. Total soluble solids were determined from the filtrate with a portable refractometer, on a scale from 0 to 32%. The result was reported as the percent soluble solids [14,15].

Titratable acidity: It was determined as the percentage of citric acid per gram of fruit pulp, the titration was done with NaOH at 0.1N, up to pH 8.1 and using 2-3 drops of phenolphthalein as indicator [18,17,14,15]. **pH**: For the determination of pH, 10 g of cuatomate *Solanum glaucescens Zucc* was liquefied with 20 mL of distilled water, and then filtered with a cloth. To 100 mL of distilled water, 10 mL of the filtrate was added, then pH readings [18,15, 16] were taken using a J.T. BAKER potentiometer, series 6630, previously calibrated, with buffer pH 4, 7 and 10.

Functional properties

Extraction of extracts

Extracts were prepared from 6 g of sample, macerated with 30 mL of ethanol (70 % v/v) and shaken for 60 min at 5000 rpm, [19]. The supernatant was filtered using Whatman No.1 filter paper and centrifuged at 2000 rpm for 30 minutes and immediately stored at 4°C in flask, to subsequently used for the determination of total phenolic compounds, total flavonoids, antioxidant capacity (DPPH).

Total phenols

The phenol content was determined by the **Folin-Ciocalteu** method as described by Herrera [20] with some modifications and using Sigma-Aldrich® brand gallic acid as a standard. Aliquots of 1.5 mL of the extract were added to 1.5 mL of *Folin-Ciocalteu* reagent, followed by 1.5 mL of 0.05 % (w/v) sodium carbonate aqueous solution. The resulting mixture was shaken and allowed to stand for 30 min. The absorbance a 765 nm was measured using the

VELAB spectrophotometer model VE-5000V. A blank sample composed of water and reagents was used as a reference. The result was expressed in milligram gallic acid equivalents (mg GAE/g ms) with reference to the gallic acid calibration curve using the following equation:

$$y = 0.0223\,x + 0.0703 \qquad \text{Eq. (1)}$$

R^2=0.9967

Total flavonoids

The determination of total flavonoids was carried out by the method proposed by Herrera [20] with some modifications. In an amber flask, 1 mL of extract was mixed with 1 mL of 1.5 % (w/v) sodium nitrite, the mixture was shaken for 5 minutes. 1 mL of the solution was placed in an amber flask and mixed with 1 mL of 3% w/v) aluminum chloride for 1 minute, then 1 mL of 1 M NaOH was added and shaken for 1 minute. Subsequently, a reading was taken in the spectrophotometer VELAB model VE-5000V at an absorbance of 490 nm. A blank sample composed of distilled water and the reagents was taken as reference. A querceteine solution (Sigma-Aldrich®) of 250was used. The result was expressed in milligram quercetin equivalents (mg EQ/g ms), considering the quercetin calibration curve.

Anti-radical activity

For the antioxidant activity of the ethanolic extracts of the samples, it was determined by elimination of free radical activity through the method described by Perez (2023) [19] with some modifications. A calibration curve was prepared from dilutions of gallic acid at concentrations of 1,2,3,4 and 5. From each dilution 1.5 mL was taken and mixed with 1.5 mL of 0.004% DPPH in an amber bottle, the mixture was kept at rest for 30 min at room temperature in the absence of light. After this time it was shaken for 1 min and a reading was taken in a spectrophotometer at a wavelength of 515 nm.

From each extract 1.5 mL was taken and mixed with 1.5 mL of 0.004% DPPH in an amber flask, the mixture was kept at rest for 30 min at room temperature in the absence of light, and then shaken for 1 min. For the blank standard (AG), 1.5 mL of 90% (v/v) ethanol was added instead of DPPH. Antioxidant activity was expressed with the parameter of IC_{50}, the concentration required of the extract to inhibit 50% of the initial concentration of DPPH. The percentage inhibition was calculated using the formula taken up by Perez (2023) [19].

$$\%de\ Inhibi^{ciión} delDPPH=\frac{(A_{DPPH}-A_{EXT}()()}{A_{DPPH}}* 100 \qquad \text{Eq. (2)}$$

Where A_{DPPH} is the absorbance of DPPH and A_{EXT} is the absorbance of the extract. From the equation obtained from the curves of controls and extracts, the IC_{50} parameter was reported in mg/extract or control/mL.

Statistical analysis

The effect of fruit maturity stage on physical (fruit weight, equatorial diameter, polar diameter and number of seeds), chemical (total soluble solids, acidity, pH, ash, protein, fat, fiber and carbohydrates by difference) and functional (phenols, flavonoids and antiradical capacity) parameters was estimated by means of an analysis of variance (ANOVA) of a completely randomized factorial design with a single factor and two levels. For each of the treatments, the comparison of means was performed using Tukey's test. All analyses were performed in the Minitab 19.0 statistical package, considering a significance level of α ≤ 0.05.

DISCUSSION AND ANALYSIS OF RESULTS

Significant differences were found in weight p= 0.025) due to fruit maturity stage, but not for polar diameter (p=0.772), equatorial diameter (p=0.506) and number of seeds (p= 0.731).

Physical characteristics of cuatomate Solanum glaucescens Zucc) due to maturity stage Fruit weight

Fruits at green maturity stage (EM1) presented higher weight (12.785g) with respect to the mature fruit (11.274g). These results differ with that reported by Hernández *et al*., (2018) [2] who reported average weights between 20 and 23 g.

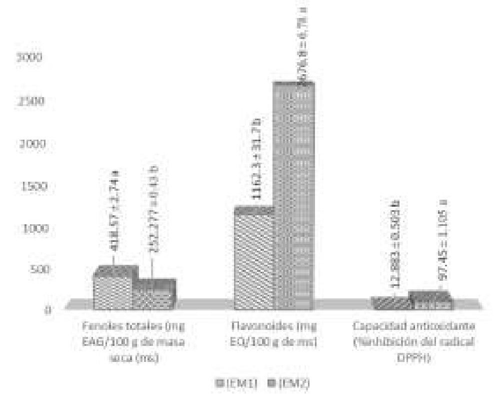
Polar and equatorial diameter

Mean equatorial and polar diameters for stages EM1 and EM6 were similar (Figure 3). Fruit diameters at maturity stage EM1 were smaller than those published by Hernández *et al*., (2020) in green cautomate fruits from the Mixtec region who report average values of 3.82 cm and 3.86 cm for polar and equatorial diameters, respectively.

Number of seeds

However, green fruits (EM1) showed a higher average number of seeds than mature fruits (Figure 4). These results are lower than those reported by Hernández *et al*, (2020) [4], who when studying green cuatomate fruits from eight municipalities of the Mixteca Poblana, reported average values of 194, 168, 160, 159, 112, 125, 145 and 144 seeds of cuatomate fruits from the municipalities of Izúcar de Matamoros, Tulcingo, Chiautla de Tapia, Acatlán de Osorio, Guadalupe Santa Ana, San Pedro Yeloixtlahuaca, Tehuitzingo and Chinantla respectively; Although the results of the last two municipalities did not show a significant difference, the number of seeds is higher than that found in the present study.

IPSUMTEC ISSN: 2594 - 2905



Comparison of means of weight (g), polar and equatorial diameter (cm) and number of seeds of cuatomate.
Means with different letters are statistically different ($P \leq 0.05$).
Source: Own elaboration, 2023

Chemical characteristics of cuatomate (Solanum glaucescens Zucc) due to maturity stage Significant difference due to maturity stage was found in moisture percentage p=0.000), protein content (p=0.000), in protein content, fat percentage (p=0.000), ash percentage (p=0.000), fiber (p=0.0000) and total carbohydrates (p=0.000), and total carbohydrates (p=0.000).
(p=0.000), pH (p=0.000), acidity (p=0.000) and total soluble solids (p=0.000) cuatomate fruits.

Humidity

The percentage of moisture was higher for fruits at maturity stage EM1 compared to mature fruits (EM6) as shown in Figure 4. The results obtained in this work are similar to 88.8± 0.76 % and 89.61 ± 0.97 % moisture for green fruits harvested in autumn and winter respectively, reported by Medina *et al*., (2014) [5]. In contrast, the moisture percentages in ripe fruits found in the present study are lower than those reported by Torres (2012) [22] for tree tomato pulp (87.72 ± 0.15 %).

Proteins

The mature fruit (EM6) presented higher protein percentage, 4.733% compared to 4.01% of green fruit protein (EM1) (Figure 4), this last value was lower than 13.17± 0.29 % and 10.53 ± 0.27% reported by Medina *et al.* [5], for fruits harvested in autumn and winter, respectively. The protein content for fruits at maturity stage EM6 reported in this research was higher than that found in ripe tree tomato pulp (1.78 ± 0.14 %) reported by Torres (2012)[22].

Fats

Higher fat content was found in the fruit at maturity stage EM6, as shown in Figure 4. The green cuatomates (EM1) presented lower fat content compared to the results obtained from the study of two different harvests of cuatomate green, as reported by Medina *et al* (2014) [5] the fruits harvested in autumn presented 2.79 ± 0.03 % while fruits harvested in winter had a fat content of 2.99± 0.05%. The fat content in ripe cuatomates (EM6) resulted to be 1.79 % fat, a value higher than 0.16 % reported by Torres (2012) [22]in a study conducted on ripe tree tomato pulp, this difference is due to the fact that in this project the whole cuatomate fruit was used.

Ashes

Higher ash percentage was found in ripe cuatomate fruits Figure 4). The ash percentage in green cuatomate (EM1) is lower than that reported by Medina *et al* (2014) [5]in two different cuatomate harvests, the authors indicate that the ash percentage was 6.53 ± 0.18 % for autumn harvest fruits and for winter of 7.03± 0.20 %; comparing the results of ash content in fruits at maturity stage EM6 with ripe tree tomato pulp [22],
0.88± 0.01 %, the results obtained in this study are superior.

Crude fiber

Green cuatomates (EM1) had a higher percentage of fiber than mature cuatomates (EM6), as shown in Figure 1.
4. These results are higher than those reported by Pantoja *et al*. (2009) [23] in tree tomato (*Solanum betaceum*) in Armella (0.91 ± 0.03%) and Vermelha (0.87 ± 0.02%) varieties.

Total carbohydrates

Ripe fruit had a higher total carbohydrate content as in Figure
4. Although the sugar content is high when ripe, this result is lower than that reported by Torres (2012)[22] in ripe tree tomato (*Cyphomandra betacea*) pulp with a percentage of 5.36. While in green cuatomates according to what was reported by Medina *et al*., (2014) [5]in two seasons of cuatomate harvests, the fruits of the autumn harvest presented a percentage of 77.51 while the winter harvest of 79.45 of total carbohydrates, these results are higher than those obtained in the present study, since the authors also determined the carbohydrates by difference, but they only obtain it from the results of proteins, fats and ashes.

pH

Green fruits presented higher average pH of 5.8567 with respect to ripe fruits with 4.97333 (Figure 4), these results are higher than those reported by Pantoja *et al*., (2009) [22] for tree tomato (*solanum betaceum*) in the varieties Armella (3.00±0.03) and Vermelha (3.84±0.02).

Titratable acidity

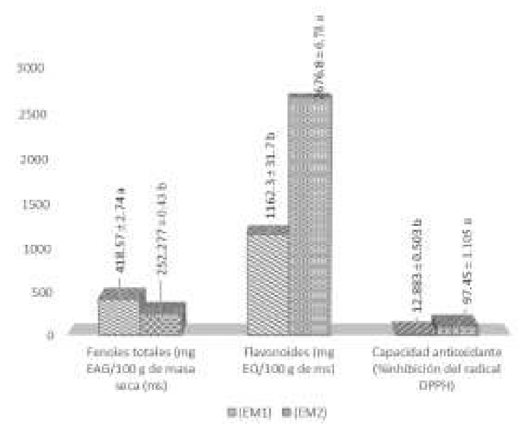
The measurement of titratable acidity, expressed as a percentage of citric acid, indicated that ripe fruit (EM6) presented a higher average than green fruit (EM1), as shown in Figure 4.

ISSN: 2594 - 2905

by Pantoja *et al.*, (2009) [23] who indicated that the tree tomato variety Armella recorded a percentage of 1.65±0.02 and Vermelha of 1.65±0.035. It was reported that for ripe pulp of tree tomato (*Cyphomandra betacea)* obtained a percentage of 0.20±0.035.
±0.00[22], this result is higher than that obtained in mature cuatomate (EM6].

Total soluble solids (TSS)

Mature fruits presented higher average total soluble solids, expressed as °Brix, as opposed to green fruits (Figure 4). Camacho (2019)
[24] reported that tree tomatoes (*Solanun betaceum*), presented values from 10.6± 0.1 to 12.9± 0.1° Brix, these results are higher than those obtained in the present study.



Comparison of means for percent moisture, protein, fat, ash, crude fiber, total carbohydrates, pH, titratable acidity and total soluble solids of cuatomate. Means with different letters are statistically different (P≤0.05).
Source: Own elaboration, 2023

Functional characteristics of cuatomate (*Solanum glaucescens Zucc*) due to the maturity stage Significant difference significant was found at the concentration of total phenols (p=0.000), flavonoids (p=0.000) and antioxidant capacity (p=0.000) due to maturity stage.

Total phenols

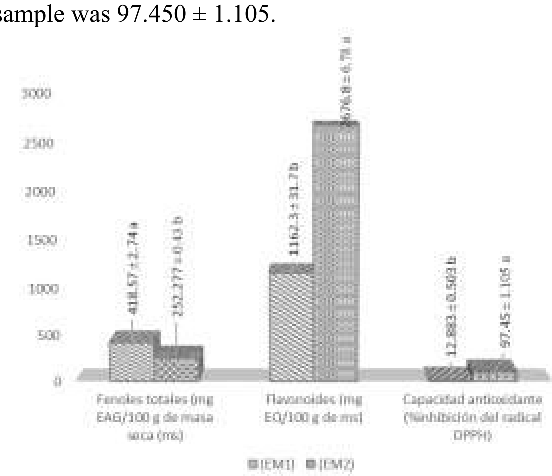
Fruits at ripening stage EM1 presented a higher average phenolics of 418.57± 2.74 mg EAG/100 g dry sample (ms) compared to fruits at ripening stage EM6, this result is higher than reported by Medina *et al*., (2014) [5] in a study conducted on green cuatomates in winter harvest, the researchers recorded a value of.
204.06 mg of total phenols/100 g of fresh weight sample, equivalent to mg of gallic acid. Ripe fruits presented a content of 252.277
± 0.43 mg EAG/100 g of dry sample, this result is higher than that reported by Bartolón (2015) [25] in tomato (*Solanum lycopersicum L.)* which reports an average of.
193.09 mg gallic acid equivalents/100 g of dry sample.

Total flavonoids

Flavonoid content in green ripening fruit (EM1) was lower than in ripe fruit (EM6), which presented higher average flavonoid content as shown in Figure 5. These results are higher than those reported by Camacho (2019) [24] in tree tomato (*solanum betaceum*), who evaluated a total of 50 samples of red tomato and reported that these samples presented a total flavonoid content ranging from 1.54 ±0.06 to 6.70 ±0.20 mg catechin/g. The difference in the results of this study and those reported by Camacho is due to the type of standard used.

Antioxidant activity against the DPPH radical.

The evaluation of the antiradical activity of phenolic compounds (PC) of cuatomate green and ripe ripening state with respect to gallic acid, used as control; show that 12.883
± 0.503 mg of green cuatomate and 97.450 ± 1.105 mg of mature cuatomate to inhibit 50 % of the DPPH radical, higher amounts with respect to gallic acid (2.8653 ± 0.006 mg/mL) to inhibit the same concentration of DPPH radical. The result obtained in green cuatomate (EM1) is lower than reported by Cobaleda (2016) [24] who indicated that for wild tomatillo *(Physalis angulata),* 30.18±1.55 mg tomatillo pulp is required to inhibit 50% of the DPPH radical. The result obtained in mature cuatomate (EM6) is higher than reported by Garcia *et al*., (2016) [26], the authors reported that to inhibit 50% of the DPPH radical, 83.06 ± 1.27 mg of red tomato pulp sample is required.
The content of antioxidant capacity in the green cuatomate sample was 12.883 ± 0.503 mg and in mature cuatomate sample was 97.450 ± 1.105.



Comparison of means of weight (g), polar and equatorial diameter (cm) and number of seeds of cuatomate.
Means with different letters are statistically different (P≤0.05).
Source: Own elaboration, 2023

CONCLUSIONS

According to the results obtained in the analysis, the average weight of the cuatomate fruit is affected by the maturity stage, but the same is not true for polar and equatorial diameter and number of seeds. The average results for moisture, fiber and pH decrease during the ripening process, but the same is not true for protein, fat, ash, carbohydrates, titratable acidity and soluble solids, which increase during the ripening process.

The results obtained for the green cuatomate sample extract presented a high content of total phenols of 418.57 ± 2.74 mg EAG/100 g dry mass (ms), while in mature cuatomate a content of 252.277 ± 0.43 mg EAG/100 g dry mass was obtained, so that the phenol content decreases as the maturity stage increases.

The determination of flavonoids in green cuatomates have lower amount of flavonoids (1162.3 ± 31.7 mg EQ/100 g of ms) compared to ripe cuatomates with high content of 2676.8± 6.78 mg EQ/100 g of dry matter, this may be affected by the state of maturity of the fruit, the riper the fruit the amount of flavonoids increases.

Higher antiradical DPPH activity was found in the green quatomates, because only 12.±
0.503 mg of green quatomate to inhibit 50% of the antiradical DPPH activity with respect to mature quatomates it takes 97.450 ± 1.105mg to inhibit 50% of the antiradical activity.

According to the results obtained in this research, it is possible to consider in future research the incorporation of the cuatomate fruit (*Solanum glaucescens Zucc.*), by identifying the type(s) of phenols and flavonoids present in the fruit through infrared analysis or gas chromatography, with the objective of knowing specifically what it contains and being able to add it to food or beverages. To elaborate products with fresh or dehydrated fruit, incorporating them in the form of flour or encapsulated.

ACKNOWLEDGMENTS

The authors would like to thank the Tecnológico Nacional de México and TecNM: Instituto Tecnológico Superior de Acatlán de Osorio, for the funding granted for the development of this research and the Head of the Food Industry Engineering Career.

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