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Profile of Phytochemical Composition and Lycopene in Fresh and Cabinet Dried *Lycopersicon esculentum* (Tomato) Fruit Proportions

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Abstract

Tomato is one of the popular and most consumed vegetable in the world. Tomatoes constitute an important agricultural crop and are an integral part of the human diet. Tomatoes have been traditionally credited as rich sources of carotenoids and vitamins; particularly β- carotene, pro vitamin A and ascorbic acid. The present work aims to explore the phytochemical composition and antioxidant activity of fresh and cabinet dried *Lycopersicon esculentum* (Tomato) fruit proportions (skin, pulp and seed). Preliminary qualitative phytochemical analysis was carried out by the standard procedure to identify the secondary metabolites like alkaloids, flavonoids, quinons, phlobatannin, phenol, saponin, tannin, terpenoids and steroids with different solvent extracts. Quantitative phytochemical test such as Alkaloids, Flavonoids and Total Phenol were also done. Preliminary qualitative phytochemical analysis was carried out by standard procedures to identify the secondary metabolites like alkaloids, flavonoids, saponins, phenols, glycosides, carbohydrates, tannins, steroids and terpenoids present in the methnolic extracts of fresh and dried tomatoes. UV spectrometry was used to do Lycopene analysis. From this study it can be concluded that fresh tomato contains number of phytochemicals.

***Key words*:** Lycopene, Biosynthesized, Phytochemistry, Phytochemical, Antioxidant

Tomato (*Lycopersicon esculentum* Mill) which belongs to the family Solanaceae is one of the three important annual fruit vegetables of the tropical region which originated in South and Central America [1]. Tomato is one of the popular and most consumed vegetable in the world. It is tasty and easily digestible and its bright colour stimulates appetite. Like other vegetable, tomato plays a very important role in human diets; because it supplies some of the nutrient deficient in other food materials e.g. tomato fruits are rich in minerals and vitamin [2]. Tomato ranks third in priority after potato and onion in India ranks second after potato in the world. India ranks second in the area as well as in production of Tomato. The major tomato growing countries are China, USA, Italy, Turkey, India and Egypt. Total area under tomato is 4582438 thousand ha with production of 150513813 thousand tons and with productivity of 32.8 tons/ha. There is a sizeable increase in acreage and production of tomato in India. There is an increase from 596.0 thousand ha in 2006-07 to 865.0 thousand ha in 2010-11, while in terms of production it has increased from 10055.0 to 16826.0 thousand tons [3]. Tomatoes are considered as a major source of carotenoids in the human diet. From a total of about 40 carotenoids present in the human diet in human blood is only 25 carotenoids which are present due to their selective intake of the digestive tract. Of these, the majority of carotenoids are present just in fresh and processed tomatoes. The most important carotenoids for humans include lycopene, lutein, zeaxanthin and β -cryptoxanthin [4]. Lycopene is a lipophilic carotenoid pigment present in tomatoes and other red fruits and vegetables. Higher amounts of lycopene are found in fruits such as of watermelon, guava and pink grapefruit [5]. In addition to liquid products, substantial markets have been developing for dried tomato products. Some of these, such as sun-dried tomatoes, have been used as ingredients for salads and other dishes. There has also been a demand for fully dried tomato powders, for use in formulated products or supplements. These have the advantage of being easier to store, may be subject to less thermal damage, and have relatively good shelf life. Powders can be produced from surplus fruit or fruits that do not meet appearance standards but are otherwise of good quality. In addition, juicing and related processes may leave a peel-rich pomace that can be converted to powders with high nutrient, phytochemical, and fiber contents [6]. The aim of this work was to analyze the phytochemical constituents and determine lycopene content of Fresh and Cabinet dried Tomato samples.

MATERIALS AND METHODS

Collection and preparation of sample

The fresh and healthy tomato fruits were collected from Dindigul market and washed thoroughly 2-3 times with running tap water and once with sterile distilled water, the surface moisture content was removed by placing the fruits at room temperature for 1 hour.

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Later the skin, pulp and seeds in tomato was separated and ground with pestle and motor with methanol for phytochemical and lycopene analysis. For dried samples skin, pulp and seeds in tomato was separated and placed in trays and the temperature was maintained at 60^0. After the heat treatment ground with domestic mixer and it was stored in air tight containers.

Alkaloids: *Mayer's test*: To the extracted sample, a drop of Mayer's reagent was added along the sides of the test tube. A white precipitate indicates the test as positive.

Flavonoids: *Alkaline reagent test*: Two ml of aqueous solution of the extract was treated with 1 ml of 10% ammonium hydroxide solution. Yellow fluorescence indicated the presence of flavonoids.

Saponins: 2 ml of the extract was diluted with 3 ml of distilled water and again diluted by adding 5 ml of distilled water and shaken. After 15 min, two layer of foam indicated the presence of saponins.

Phenols: *Ferric chloride test*: 2 gm of the sample was dissolved in 2ml of distilled water. To this, few drops of neutral 5% ferric chloride solution was added. A dark green colour indicates the presence of phenolic compounds.

Glycosides: 2 gm of plant extract was hydrolyzed with concentrated hydrochloric acid for hours on a water bath, filtered and the hydrolysate was subjected to the following test. Sample was dissolved in 1ml water and then aqueous 10% sodium hydroxide was added. Formation of a yellow colour indicated the presence of glycosides.

Tannins: 2 gm of extract and one ml of water and 1-2 drops of ferric chloride solution was added. Blue colour was observed for gallic tannins and green black for catecholictannins.

Steroids: Libermann-Burchard reaction: 2g of the extract was treated with 0.5 ml of acetic anhydride and 0.5ml of chloroform. Then concentrated sulphuric acid was added slowly and green bluish colour for steroids was observed.

Terpenoids: 2 gm of extract was treated with 0.5 ml of acetic anhydride and 0.5 ml of chloroform. Concentrated sulphuric acid was added slowly along the sides of the test tube. Red violet colour was observed for terpenoids.

Quantitative phytochemical analysis

Quantitative phytochemical analysis of fresh and dried samples was done. Alkaloids, flavanoids and total phenol were quantified with the standard procedures. Alkaloids determination by using Harborne [7] method 5g of the sample was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added and covered and allowed to stand for 4 h. This was filtered and the extract was concentrated on a water bath to one quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitated was collected and washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed. Flavanoid determination by the method of Bohm and Kocipai- Abyazan [8]. 10g of the plant sample was extracted repeatedly with 100 ml of 80% aqueous methanol at room temperature. The whole solution was filtered through Whatman filter paper No 42 (125 mm). The filtrate was later transferred into a crucible and evaporated into dryness over a water bath and weighed to a constant weight.

Total phenol determination

Determination of total phenolic content Folin–Ciocalteu procedure given by Yu *et al*. [9] was used to estimate the total phenolic contents in the methanol extract of the plants. Following this method, 0.1 ml of fractions was diluted to 1 ml with distilled water. To this solution 0.5 ml of Folin–Ciocalteu reagent (2N, 1:1) and 1.5 ml of 20% sodium carbonate solution was added. The mixture was incubated for 2 h at room temperature. The volume was raised to 10 ml with distilled water and the absorbance of blue colored mixture was measured at 765 nm. The amount of total phenol was calculated as mg GAE/g from calibration curve of Gallic acid standard solution.

Lycopene analysis

Lycopene analysis was done with fresh and dried samples of tomato, added 0.1mg of sample in test tube added 8.0 ml of hexane: ethanol: acetone (2:1:1) vortex the test tube immediately, then incubate out of bright light and the test tube stand to at least 10 minutes. Added 1.0 ml water to each sample and vortex again. Samples stand for 10 minutes to allow phases to separate. Determination of lycopene in A503 of the upper layers of the test tube [10].

Calculation of lycopene levels. Lycopene levels in the hexane extracts were calculated according to:

Lycopene (mg/kg fresh wt.) = A503 × 17.17 × V

Where; V is the volume of mixed solvent added.

RESULTS AND DISCUSSION

Data depicted in (Table 1) depicts the presence of alkaloids, flavonoids, phenol, saponin, tannin, terpenoids, quinons, phlobtannin and steroid was present in methanol extract of fresh fruit proportions. Tomato pulp revealed that the presence of alkaloids, flavonoids, phenol and saponin except of tannin, quinons and steroids. Tomato seed reported that the presence of alkaloids, flavonoid, saponin, tannin, terpenoids, quinons and steroid except phlobtannin. Tomato skin has observed with all the phytochemicals. The presence of phytochemicals in the ethanol extracts of tomato fruit proportions shows that the skin contains alkaloids, flavonoids, phenol, saponin, tannin, terpenoids, quinons, phlobtannin and steroid; Pulp contains alkaloids, flavonoids, saponin, tannin, terpenoids, and steroid: Seed contains alkaloids, Phenol and saponin [11-13].

Chloroform extract of fresh tomato skin was contains alkaloids, phenol, saponin, tannin, phlobtannin and steroid. Flavonoids, terpenoids and quinons are not present in the tomato skin. pulp comprising phenol, saponins and steroids. Seed had saponin, phlobtannin and steroid. The presence of phytochemicals in the acetone extracts of tomato fruit proportions shows that the skin contains flavonoids, phlobtannin and steroid. Pulp had alkaloids, flavonoids, saponin, tannin and terpenoids. Alkaloids, phenol, saponin, terpenoids, quinons are phlobtannin present in tomato seed. In petroleum ether extracts of fresh tomato skin shows that the presence of alkaloids, flavonoids, phenol, saponin, tannin, phlobtannin and steroid. Absence of terpenoids and quinons. Pulp reveals that the presence of alkaloids, flavonoids, phenol and tannin and absence of saponin, terpenoids, quinons, phlobtannin and steroid. When compared with skin and pulp its seed had all the phytochemicals except phlobtannin [14-15].

Table 1 Qualitative phytochemical composition of fresh tomato proportions

Solvent	Proportions	Alkaloids	Flavonoids	Phenol	Saponin	Tannin	Terpenoids	Quinons	Phlobatannin	Steroids
Methanol	Skin	+++	+++	+++	+++	+++	- ++	+++	+++	+++
	Pulp	+++	- ++	+++	+++	- - -	+++	- - -	+++	- - -
	Seed	+++	+++	- - -	+++	+++	+++	+++	- - -	+++
Ethanol	Skin	+++	+++	+++	+++	+++	+++	- - -	+++	+ + +
	Pulp	+++	+++	+++	+++	- - -	- - -	- - -	+++	- - -
	Seed	+++	- - -	+++	+++	- - -	- - -	- - -	- - -	- - -
Chloroform	Skin	+++	- - -	+++	+++	+++	- - -	- - -	+++	+++
	Pulp	- - -	- - -	+++	+++	- - -	- - -	- - -	- - -	+++
	Seed	- - -	- - -	- - -	+++	- - -	+++	- - -	+++	+++
Acetone	Skin	- - -	+++	- - -	- - -	- - -	- - -	- - -	+++	+++
	Pulp	+++	+++	- - -	+++	+++	+++	- - -	- - -	- - -
	Seed	+++	- - -	+++	+++	- - -	+++	- - -	+++	- - -
Petroleum	Skin	+++	+++	+++	+++	+++	- - -	- - -	+ + +	+++
ether	Pulp	+++	+++	+++	- - -	+++	- - -	- - -	- - -	- - -
	Seed	+++	+++	+++	+++	+++	+++	+++	- - -	+++

- Absence + Presence

Table 2 Qualitative phytochemical composition of dried tomato proportions

Solvent	Proportions	Alkaloids	Flavonoids	Phenol	Saponin	Tannin	Terpenoids	Quinons	Phlobatannin	Steroids
Methanol	Skin	+++	+++	- ++	+++	- - -	- - -	- - -	- - -	- - -
	Pulp	+++	+++	+++	+++	- - -	+++	- - -	+++	- - -
	Seed	+++	+++	+++	+++	- - -	- - -	- - -	- - -	- - -
Ethanol	Skin	+++	- - -	- - -	- - -	- - -	- - -	+++	- - -	- - -
	Pulp	- - -	+++	- - -	- - -	+++	+++	- - -	- - -	+++
	Seed	+++	+++	- - -	- - -	- - -	- - -	- - -	+++	- - -
Chloroform	Skin	+++	- - -	- - -	- - -	+++	+++	+++	+++	+++
	Pulp	+++	+++	- - -	- - -	+++	+++	- - -	- - -	+++
	Seed	+++	+++	- - -	+++	+++	+++	+++	+++	+++
Acetone	Skin	- - -	+++	- - -	- - -	- - -	- - -	- - -	+++	+++
	Pulp	+++	- - -	- - -	+++	+++	- - -	- - -	- - -	- - -
	Seed	+++	- - -	+++	- - -	- - -	+++	- - -	+++	- - -
Petroleum	Skin	+++	- - -	- - -	- - -	- - -	- - -	- - -	+++	+++
ether	Pulp	+++	+++	- - -	- - -	- - -	- - -	- - -	- - -	- - -
	Seed	+++	+++	- - -	- - -	- - -	+++	+++	- - -	- - -

- Absence + Presence

Methanol extracts of dried tomato skin had alkaloids, flavonoids, phenol and saponin except tannin, terpenoids, quinons, phlobtannin and steroid. Pulp reported that the presence of alkaloids, flavonoids, phenol, saponin, terpenoids and phlobtannin and absence of tannin, quinons, and steroid. Seed contains of alkaloids, flavonoids, phenol and saponin. Ethanol extracts of dried tomato skin had alkaloids and quinons. Pulp contains flavonoids, tannin, terpenoids and steroid. Seed shows that the presence of alkaloids, flavonoids and phlobtannin. Chloroform extract revealed that the presence of alkaloids tannin, terpenoids, quinons, phlobtannin and steroid were present in tomato skin. Alkaloids, flavonoids, tannin, terpenoids and steroid were present in tomato pulp. Alkaloids, flavonoids, saponin, tannin, terpenoids, quinons, phlobtannin and steroid were present in seed except phenol. Acetone extracts of dried tomato skin was found that the presence of following phytochemicals flavonoids, phlobtannin and steroid. Alkaloids, saponin and tannin present in pulp. Seed shows that the presence of following phytochemicals such as alkaloids, phenol, terpenoids and phlobtannin. Chloroform extracts of dried tomato skin reveals that the presence of alkaloids, phlobtannin and steroid. Pulp had alkaloids and flavonoids. Seed was containing alkaloids, flavonoids, terpenoids and quinons [16].

Table 3 Quantitative phytochemical composition of fresh and dried tomato proportions

Fresh / dried	Proportions	Alkaloids	Total phenol	Flavanoids
Fresh	Skin	82.12 ± 1.52	41.65 ± 0.81	46.02 ± 1.15
	Pulp	80.88 ± 1.48	76.17 ± 0.45	81.97 ± 1.32
	Seed	45.96 ± 1.56	9.60 ± 0.77	7.31 ± 0.15
Dried	Skin	66.17 ± 0.65	24.40 ± 0.83	56.74 ± 4.17
	Pulp	53.7 ± 5.69	72.40 ± 0.14	59.39 ± 0.44
	Seed	78.37 ± 0.25	6.62 ± 0.49	13.58 ± 0.45

The data in (Table 3) revealed that the phytochemical constituents present in fresh tomatoes in methanol extracts. When compared to tomato seed and pulp tomato skin contains rich sources of alkaloids flavonoids, phenols, glycosides, tannins, steroids and amino acids followed by tomato pulp and seed. This distribution suggests that the skin of the tomato is especially valuable for its phytochemical content, making it a potent source of health-promoting compounds [17].

Data in (Table 4) shows the lycopene content of fresh and cabinet dried tomato samples. Cabinet dried sample contain high lycopene content compared with the fresh samples of skin (97.37), pulp (52.06), seed (0.21). These results suggest that the drying process enhances the concentration of lycopene in tomatoes, particularly in the skin and pulp. This could be due to the reduction in water content during drying, leading to a higher concentration of lycopene per unit weight [18].

Table 4 Lycopene analysis of fresh and cabinet dried tomato samples

Tomato	Portions	Lycopene content 100mg/ml
Fresh sample	Skin	42.52µg
	Pulp	31.80µg
	Seed	1.02µg
Cabinet dried sample	Skin	97.37µg
	Pulp	52.06µg
	Seed	0.21µg

CONCLUSION

The dried tomato skin powder has greater initial lycopene, which was retained after drying below 60°C. These powders also had somewhat better flow ability than tomato pulp powders. This conclusion is as a result of the abundant of phytochemical constituents present in fresh tomato's skin, seed and pulp. Heat treatment leads to an increase in the content of Lycopene that can be attributed to better availability of these components in the human body.

LITERATURE CITED

1. Jules J. 2001. *Horticulture Review*. Oxford University Press Ltd., United State of American. pp 240-296.
2. Biwasi EC. 1999. Cumulative effect of different level of manure on the physical properties of soil. *Journal of Indian Soil Science* 19: 31-33.
3. Anonymous. 2011. Indian Horticulture Database. http://agriexchange.apeda.gov.in/Market%20Profile/one/TOMATO.aspx.
4. Shi J, Le Maguer M. 2000. Lycopene in tomatoes: chemical and physical properties affected by food processing. *Crit. Rev. Food Science and Nutrition* 40(1): 1-42.
5. Shi J, Le Maguer M, Bryan M. 2002. Lycopene from tomatoes. *In*: (Eds) Shi, J., le Maguer, M., Schulzova, V. 2005. The 2005th New developments in the area of quality organic produce. *The Scientific Committee on Plant Health, Environment*.
6. Del Valle M, Cámara M, Torija ME. 2006. Chemical characterization of tomato pomace. *Journal of the Science of Food and Agriculture* 86: 1232-1236.
7. Harborne. 1973. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Chapman and Hall, London, UK.
8. Bohm BA, Kocipai- Abyazan R. 1994. Flavonoid and condensed tannins from the leaves of *Vaccinum raticulation* and *Vaccinum calcyimium*. *Pacific Science* 48: 458- 463.
9. Yu L, Haley S, Perret J, Harris M. 2002. Antioxidant properties of hard winter wheat extracts. *Food Chemistry* 78(4): 457-461.
10. Jancy Rani D, Vijayanchali SS. 2017. Phytochemical, antioxidant activity and Lycopene analysis of red guava fruits. *Journal of Research, Extension and Development* 6(2): 25-30.
11. Shad AA, Ahmad S, Ullah R, AbdEl-Salam NM, Fouad H, Ur Rehman N, Hussain H, Saeed W. 2014. Phytochemical and biological activities of four wild medicinal plants. *Scientific World Journal* 2014: 857363.
12. Jancy Rani D, Vijayanchali SS. 2021. Phytochemical composition and antioxidant activity of fresh and dried grape (*Vitis vinifera*) fruit proportions. *International Journal of Innovative Science and Research Technology* 6(4): 734-739.
13. Silva-Beltrán NP, Ruiz-Cruz S, Cira-Chávez LA, Estrada-Alvarado MI, Ornelas-Paz Jde J, López-Mata MA, Del-Toro-Sánchez CL, Ayala-Zavala JF, Márquez-Ríos E. 2015. Total phenolic, flavonoid, tomatine, and tomatidine contents and antioxidant and antimicrobial activities of extracts of tomato plant. *Int. Jr. Anal. Chemistry* 2015: 284071.
14. Mujeeb F, Bajpai P, Pathak N. 2014. Phytochemical evaluation, antimicrobial activity, and determination of bioactive components from leaves of *Aegle marmelos*. *Biomed. Res. Int.* 2014: 497606.
15. Ushie OA, Neji PA, Abeng FE, Okpashi VE, Baba NH, Azuaga TI. 2019. Phytochemical screening and antimicrobial activities of chloroform and ethyl acetate extracts of *Physalis angulate. Jr. Chem. Soc. Nigeria* 44(6): 1062-1069.
16. Sharma V, Agarwal A. 2015. Physicochemical and Antioxidant assays of methanol and hydromethanol extract of ariel parts of *Indigofera tinctoria* Linn. *Indian Jr. Pharm. Sciences* 77(6): 729-734.
17. Oleszek M, Kowalska I, Bertuzzi T, Oleszek W. 2023. Phytochemicals derived from agricultural residues and their valuable properties and applications. *Molecules* 28(1): 342.
18. Dufera LT, Hofacker W, Esper A, Hensel O. 2021. Physicochemical quality of twin layer solar tunnel dried tomato slices. *Heliyon* 7(5): e07127.