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Review Article

Analysis Of Phenolic Acids In Varities Of *Solanum Lycopersicum* Cultivated In Chhatrapati Sambhajinagar

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ABSTRACT

Tomatoes (solanum lycopersicum) are widely cultivating vegetable globally, prized for their culinary versatility and nutritional value. The contents of phenolic acids vary among varieties of tomatoes and phenolic acids are known for their antioxidant properties. Tomatoes plants breeding has been performed in Maharashtra state, India by using varieties of hybrid seeds to improve their biologically active phenolic acids contents. In the present investigation, I have selected three hybrid varieties of tomatoes named as ATV1, and Parbhaniyashisree to analyze the total phenolic acids in their extract (tomato peels) by colorimetric method using Folin-Ciocalteu reagent. Alkaline extraction process applied to tomato skins is cheap and the highest extraction yield per 25 g dry extract was found in Vasundhara tomato variety compare to other varieties. Total phenolic contents were found higher amount compare to native tomato peels. Therefore tomato skins treated with alkali contain various phenolic acids and has promising anti-oxidant properties

INTRODUCTION

Tomato (Solanum lycopersicum L.) is one of the most popular vegetables with an annual production of 187 million tons worldwide (FAOSTAT, 2020). It contains several bioactive compounds that have been associated with health-promoting aspects such as the prevention of diseases related to oxidative stress (Pinela et al., 2016), treatment of cancer and cardiovascular diseases (Boehm V. 2012. Lycopene and heart health. Molecular Nutrition, 2012; Friedman, 2013). Tomatoes contain a variety of valuable nutrients such as polyphenols, carotenoids, pectin, fiber, and fatty acids (Szabo et al., 2019b). Among them, phenolic compounds have attracted particular interest due to their role in preventing various oxidative stress related diseases (Shahidi and Ambigaipalan, 2015) and their anti-inflammatory activity and antimicrobial potential (Calinoiu and Vodnar, 2018). Caffeic acid, chlorogenic acid, p-coumaric acid, ferulic acid, rosmarinic acid, quercetin, and

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rutin have been described as phenolic compounds in tomato peels (Cetkovic et al., 2012). Several methods have been used to extract bioactive compounds from tomato peels. Alkali extraction with/without heat treatment has been recognized as an alternative method, especially for the recovery of bound phenols closely related to cell wall polysaccharides in plant tissues and their agro-industrial by-products. Alkali treatment was reported to facilitate the extraction of more polyphenols from kiwifruit peels, pulp, and seeds with higher resolution in HPLC compared to extraction with organic solvents (Sun-Waterhouse et al., 2009). Several studies emphasized that alkali treatment can favor the extraction of some bound phenols such as p-coumaric acid, ferulic acid, and caffeic acid from wheat bran (Kim et al., 2006; Verma et al., 2009) and rice husk (Nenadis et al., 2013) by contributing significantly to the antioxidant capacity. In this context, this study aims to determine the optimized extraction conditions and TPC of tomato peels. We believe that the results of this study will help valorize new varieties of tomatoes and point to new studies on the production of functional bioactive foods from tomato.

REVIEW OF LITERATURE

The attempts has been made in this chapter to review the work done in past on this aspect of present investigation by eminent scientists in India and abroad.

Rebecca et al., (2003)

studied in analysis the phenolic acid in vegetable fruits epidemiological evidence indicates that a diet rich in plant derived foods significantly reduces the risk of many types of cancers and cardiovascular diseases, suggesting that certain dietary antioxidants could be effective agents for the prevention of cancer incidence and mortality. Polyphenols, found in these remedies, are considered to be the chief agents responsible for the biological functions and disease cure. Plant phenolics including simple phenols, phenolic acids, flavonoids, coumarins, stilbenes, hydrolyzable and condensed tannins, lignans, and lignins are the most abundant secondary metabolites, produced mainly through the shikimate pathway from L-phenylalanine and L-tyrosine, and containing one or more hydroxyl groups attached directly to aromatic rin.

Friedman et al., (2005)

studied phenolic acids in food some reports have shown that tomato fruit extracts exhibit antimicrobial and anticancer properties the phenolic contents of tomato fruits have been correlated with their antioxidant capacity. These compounds also prevent oxidative changes in cells by reducing the levels of free radicals, and epidemiological reports suggest.

Kaushik at el., (2015)

studied the breeding vegetables with increase content in bioactive phenolic accorrelation between the antioxidant capacity of tomatoes and a decreased risk of developing cardiovascular disease and cancer. In addition to these properties, tomato byproducts, such as the seeds, represent an attractive source of fiber that also shows antimicrobial activities tomato plants also possess bioactive components with pharmacological and nutritional properties.

MATERIALS AND METHODS:

MATERIALS:

Sodium hydroxide, hydrochloric acid, folin-ciocalteu reagents, gallic acid, sodium carbonate, ethanol (99.96% purity), and methanol (99.99% purity).

Methods:

1. Sample Preparation:

Fresh tomatoes were purchased from local market, Aurnagabad, Mahrashtra, India. The pomace was sedimented in containers filled with water to separate the seeds from the skins. Then, the peels were dried in an oven dryer at 60°C for 8 h with an airflow velocity of 1 m/s. The dried tomato peels

were then ground using a pestol and mortor and sieved with a pore diameter of 500 µ. The dried peels were then stored at freezer, airtight packaging until the extraction process began.

2. Alkaline Extraction of Tomato Peels

The extraction was performed according to the procedure described by Cifarelli and Benitez (Cifarelli et al., 2016; Benitez et al., 2018). In each experiment, samples were treated with NaOH solution (3% w/v) at a solvent: solute ratio of 10:1. After filtration, the residue was rinsed twice with excess distilled water, and the supernatant was combined with the filtrate. The supernatant was then acidified with 3 M HCl until the pH of the solution reached 4.3. The samples were then centrifuged at 4000 rpm for 15 min and rinsed three times with alkaline water (pH=8.45) until the pH reached 6.5. This procedure was performed to remove acid-insoluble lignin from the tomato peel extracts (Mussatto et al., 2007). Since lignin can bind the phenols, this procedure facilitated the release of phenols. The precipitates were then freeze-dried using a freeze dryer. The precipitates were then immediately weighed and stored at freezer until the start of the analysis.

3. Determination of Total Phenolic acids Content (TPC)

The TPC of tomato peel extracts (TPE) was determined by the Folin-Ciocalteu method (Xu and Chang, 2007). Gallic acid was used as a standard and the results were expressed as gallic acid equivalents (GAE). For extraction of phenolic compounds, the dried extract was treated with ethanol (96% v/v), then 50 µL of the mixture was shaken for 30 seconds after the addition of 250 µL Folin-Ciocealtau reagent and 3 mL distilled water. 750 µL sodium carbonate solution (7% w/v) was added to the mixture and shaken for another 30 seconds. Then 950 µL of distilled water was added to each sample and gently stirred. The mixture was allowed to stand at room temperature in the dark for 2 h. The absorbance of the mixture was measured at 765 nm using a spectrophotometer. A calibration curve of gallic acid in ethanol (96%) at different concentrations was plotted against the absorbance values. The TPC for each sample was calculated from the linear function of this curve. The results were expressed as mg of gallic acid (GAE)/25 g of dried extract.

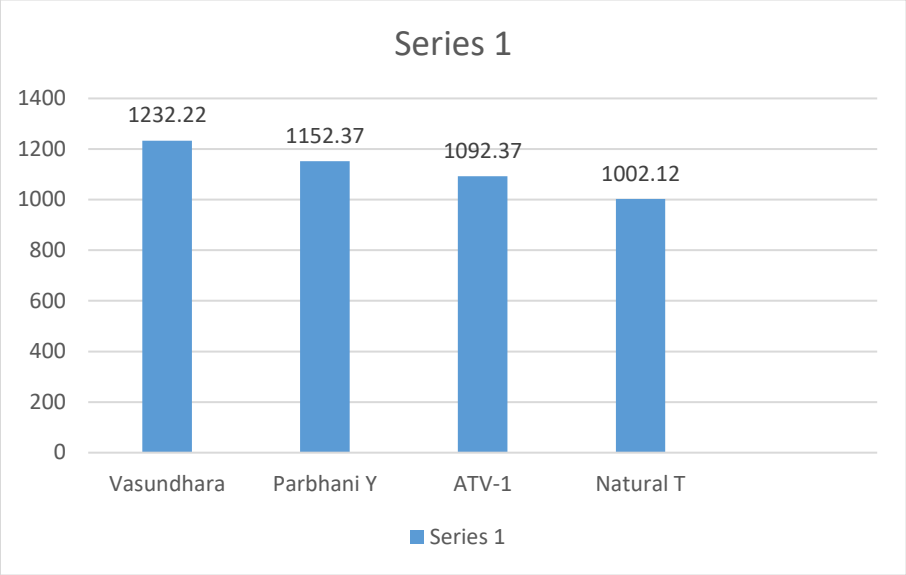
RESULTS:

The experimental results are shown in Table 1. The extraction yield ranged from 2.20 to 5.04 g /25 g dry peel. The highest yield (5.04) was obtained in Vasundhara, ATV1 has yielded minimum (2.20) and Parbhani, yashisree has yielded moderate (3.50) in dried peels and natural tomato has yielded (1.90). The highest TPC (2232.22mg GAE/25g dry extract) was determined in Vasundhara, the moderate phenolic content was found in (1152.37mg GAE/25g dry extract) Parbhaniyashisree and considerable value was obtained in ATV1 (1092.37mg GAE/25g dry extract). Natural tomato has shown considerable value of phenolic acids (1002. 12mg GAE /25g dry extract).

Table 1:Total phenolic acids content in varieties of tomato peels

Tomato variety	TPC (mg GAE/25 g dry extract)
Vasundhara	2232.22
Parbhaniyashisree	1152. 37
ATV1	1092. 37
Natural tomato	1002. 12

Bar graph:



Level of Phenolic Acid

DISCUSSION:

Plants contain a large variety of phenolic derivatives. These compounds are essential for plant growth and repro- duction. In addition, phenolic compounds are natural antioxidants that may occur in all parts of the plant and function as antibiotics and natural pesticides [V. K. Gupta 2014]. Table 1 shows the total phenol contents of plant tomato varieties. All of the new tomatoes verities which are grown in Maharashtra state, India displayed significantly higher phenolic contents compared to the old natural variety. In contrast, the native variety tomato extracts displayed the lowest phenolic contents, showing that the highest yield (5.04) was obtained in Vasundhara, ATV1 has yielded minimum (2.20) and Parbhaniyashisree has yielded moderate (3.50) in dried peels and natural tomato has yielded (1.90). The highest TPC (2232.22 mg GAE /25 g dry extract) was determined in Vasundhara, the moderate phenolic content was found in (1152.37mg GAE/25g dry extract) Parbhaniyashisree and considerable value was obtained in ATV1 (1092.37mg GAE/25g dry extract). Natural tomato has shown considerable value of phenolic acids (1002.12mg GAE/25g dry extract). Hence, the extracts derived from the tomatoes peels of the four varieties represent potential anti-oxidants preservatives for use in foods or in pharmaceutical industries. It is also important to note that most of the available scientific reports are focused on the antimicrobial activity of tomato vegetable extracts [M. Taveira 2010].

CONCLUSION:

Tomato peels contain an appreciable amount of phenolic compounds with a wide variety. Among all investigated tomatoes varieties TPC most abundant in Vasundara compare to others in alkali-digested tomato peels of ecological and environmental point of view. Alkali treatment is an effective method to extract the bound phenolics in tom peels. The results revealed that local environment of Maharashtra India and temperature has crucial roles in the yield and content of total phenolic acids synthesis in the vegetable tomato. .

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