Research Article **JPRR (2018) 2:9**

Journal of Pharmaceutical Research and Reviews (ISSN:2576-8417)

Chemical profiling of *Solanum lycopersicum*

Neji, P. A1 *Ushie O. A2, Neji, H. A3 Opara, I. J2 and Ojong, O. O4

1Dept of Chemical Sciences, Cross River University of Technology, Calabar Nigeria
2 Dept of Chemical Science, Federal University, Wukari Nigeria
3 Dept of Science Education, University of Calabar, Calabar
4Dept of Pure and Applied Chemistry, University of Calabar

ABSTRACT

Introduction

Consumed in diverse ways, including raw, as an ingredient in many dishes, sauces, salads and drinks, tomato is the edible, often red berry type fruit of the nightshade solanum lycopersicum commonly known as tomato plant. Extreme health disorders suffered as a result of insufficient vitamins, unbalanced diets and malnutrition have severe or may lead to severe health consequences or diseases in humans. Planning/attempts to resolve such health inbalances as bleeding from the gums, joint pains, low concentration of ascorbate in plasma, blood, or leukocytes, which is commonly attributed to scurvy, all rely on the knowledge of the concentration of vitamins in the diets of the patient. One cannot tell to what extent a feed is both nutritious and medicinal if some analysis are not carried out on the feed. This is why the assessment of vitamin C, phytochemical and proximate evaluations of commercial fruits, using tomato is necessary, so as to know their vitamin C percentages, which medicinal properties they possess and qualitatively, the different macro nutrients they contain.

In the view of the problem above, the aim of this paper was to assess the concentration of ascorbic acid, medicinal and macronutrients in commercial fruit – tomato, carrying out significant calculations tilted toward achieving the right proportions of significant nutrient constituents in the samples of tomato.

***Correspondence to Author:**
Ushie O. A
Dept of Chemical Science, Federal University, Wukari Nigeria

How to cite this article:
Neji, P. A, Ushie O. A, Neji, H. A Opara, I. J and Ojong, O. O Chemical profiling of Solanum lycopersicum. Journal of Pharmaceutical Research and Reviews, 2018; 2:9.

eSciencePublisher
eSciPub LLC, Houston, TX USA.
Website: http://escipub.com/

MATERIALS AND METHODS

Sample Collection

The fruit sample of *solanum lycopersicum* to be analyzed was bought from Mrs. Lawrencia Ekong of shop No. 34 Victory Line Via Calabar Road, Wart market, Calabar.

Sample Extraction

Solvents used for extraction were distilled water and petroleum ether. For water extraction, 20g of the ground sample of *solanum lycopersicum* was weighed separately and packed into extraction thimble and fitted into soxhlet sets. The soxhlet apparatus was heated under reflux using heating mantle for six (6) hours until extraction was completed. The same process was repeated for the samples using petroleum ether, and the extracts obtained were transferred to reagent bottles after cooling and kept safely in the laboratory for use.

Proximate Analysis

The proximate composition of *solanum lycopersicum* was determined using the methods (A.O.A.C, 1990). The proximate analysis includes moisture, ash, crude fibre, crude lipid, crude protein, carbohydrate.

Determination of Moisture Content

The fresh sample was weighed 5g into beaker and placed in an oven for about six (6) hours at a temperature of 100^{o}C. The weight was taken after drying. The loss in weight was expressed as a percentage of the initial weight, thus the difference in weight indicates the amount of water contained in the samples.

$$\% \text{ Moisture} = \frac{\text{loss in weight on drying}}{\text{Initial sample weight}} \times \frac{100}{1}$$

Determination of Ash Content

The ash content was determined from the loss in weight after ashing of 5g of the ground samples at 50^{o}C using a muffle furnace. This temperature was considered high enough to allow organic matter to be burnt off without appreciable decomposition of the ash content.

Determination of Crude Fibre Content

Ground samples were weighed 5g each and put into beakers. 50ml of 1.25% H_2SO_4 acid solution was added and made up to 200ml with distilled water and stirred. The mixture was heated with continuous stirring for thirty (30) minutes and allowed to cool and settle. Distilled water was added and allowed to settle, then decanned. Decantation was repeated for six (6) times consecutively to make the mixture acid free. 50ml of 1.25% NaOH was added to the mixture and made up to 200ml with distilled water in a beaker, and heated for thirty minutes with continuous stirring. It was allowed to cool and settled. Distilled water was added and decanned for six (6) times consecutively. The mixture was filtered with filter paper and kept for about forty-five minutes for water to drain completely, and weights taken.

Determination of Crude Fat Content

Ground sample was weighed 5g into a beaker of known weight. The crude fat was extracted in a soxhlet extractor using petroleum ether (B.P 40-60^{o}C) as solvent. When the extraction was completed, the solvent was evaporated off by placing in an oven at a temperature of 150^{o}C. The weight of the extract left was taken as the weight of crude fat in the samples.

$$\% \text{ Fat} = \frac{\text{Weight of extract}}{\text{Weight of sample used}} \times \frac{100}{1}$$

Determination of Crude Protein

Sample was digested 5g with 30ml of concentrated sulphuric acid using 2g of copper sulphate and 16.0g of sodium sulphate salt until a clear green solution was obtained. This was dissolved in distilled water and made up to 100ml in a volumetric flask, 12.5ml of the digest was measured into a semi-micro Kjeldhol Markham distillation apparatus and treated with 12.5ml of 1.25% of sodium hydroxide (NaOH) solution. This was distilled with 10ml of boric acid and double indicator. The distillate was then titrated with 0.1% HCl solution until a light pink end point was reached. Blank titration was also carried out in similar manner.

Distillation was carried out in triplicate and the percentage nitrogen obtained by appropriate calculation.

$$\% \text{ Nitrogen} = \frac{\text{Ml of Hcl (blank)} - \text{Ml of Hcl (sample)} \times 0.1\text{M Hcl} \times 14 \times 100 \times 100}{\text{Weight of sample} \times \text{Ml of digest} \times 1000} \times \frac{6.25}{1}$$

Determination of Carbohydrate

The carbohydrate content of tomato was determined by the difference obtained after subtracting total organic nitrogen, fat, ash and fibre from the total dry matter.

Phytochemical Screening

Phytochemical screening procedures carried out were adapted from previous work on plant analysis (Sofowora, 1984). This analysis determined the biologically active non-nutritive compound that contributes to the flavor, colour and characteristics of plants part. The extracts were used for the following plant constituents, Cardiac glycosides, alkaloids, Saponins, tannins, flavonoids, polyphenols, reducing sugars, phlobatannins, anthranoids, and anthraquinones using the methods described below:

Test for Cardiac Glyconsides

Small amount of aqueous extracts (2ml) was dissolved in 2ml of chloroform. Concentrated sulphuric acid was carefully added to form a lower layer. A reddish brown colour at the interface indicate the presence of glycone of the cardiac glycosides (Singh *et al*, 1970).

Test for Alkaloids

Small amount aqueous plant extracts (2ml) was put in a test tube and treated with 10ml of 1% hydrochloric acid for 10 minutes in a water bath 1ml of the filtrate was treated with a drop of Mayer's regent. Turbidity or precipitate with either of this regent was taken as presence of alkaloids. (Kittakoop *et al*, 2014).

Test for Saponins

Small amount of aqueous plant extracts (2ml) was shaken with distilled water in a test tube, frothing which persists on warming was taken as evidence for the presence of saponins (Sofowora, 1984).

Test for Tannins

Small amount of aqueous extracts (2ml) was stirred with 10ml of distilled water. This was filtered and 1% ferric chloride added to the filtrate, blackish blue precipitate indicate the presence of hydrolysable tannins (Gallic) while the blackish-green precipitate indicates the presence of condensed tannins – (Cothecol).

Test for Flavonoids

Small amount of aqueous extracts (2ml) was added to a few pieces of magnesium metal and concentrated hydrochloric acid was added. The formation of orange, red crimson or magenta was taken as an evidence for the presence of flavonoids**.** (Galeotti *et al*, 2008)

Test for Polyphenols

Small amount of aqueous extracts (2ml) with 10ml of distilled water was heated for 30 minutes. 1ml of 1% $FeCl_2$ was added to the mixture and followed by the addition of 1ml of 1% potassium ferrocyanide to the solution. This was filtered and the formation of a green-

blue colour indicates the presence of polyphenols

Test for Reducing Sugars

Small amount of aqueous fruit extracts (2ml) was put in a test tube and 5ml of fehling's solution added to it and heated in a water bath. The formation of a brick-red precipitate was taken as evidence for the presence of a reducing sugar.

Test for Phlobatannins

Small amount of aqueous fruit extracts (2ml) was boiled with 1% HCl. The deposition of a red precipitate was taken as evidence for the presence of phlobatannins.

Test for Anthranoids

Small amount of aqueous fruit extracts (2ml) was boiled with 5ml of potassium hydroxide (KOH). The solution was filtered through glass wool. The filtrate was treated with 1% acetic acid and the resulted solution was mixed with toluene. The upper layer was transferred to another test tube and potassium added. The presence of a red colour indicates the presence of anthranoids.

Test for Anthraquinones

Small amount of aqueous fruit extracts (2ml) was shaken with 10ml of benzene. This was filtered and 5ml of 1% ammonia solution was added to the filtrate. The mixture was shaken and the presence of a pink, red or violet colour in ammonical (lower) phase indicates the presence of anthraquinones (Harish *et al*, 2011).

Vitamin C (Ascorbic Acid).

The method for the determination of the concentration of ascorbic acid used was that of oxidation Reduction (Redox) titration using iodine solution. 100g each of the fruit sample was cut into small pieces and blended in a food processor together with 50ml of distilled water. After blending, the pulps for each fruit was strained through cheese-cloth, washing it with a few 10ml portions of distilled water, and the extracted solution made up to 100ml in a volumetric flask.

Titration

20ml aliquot of the sample solutions was pipette into a 25ml conical flask and 150ml of distilled water and 1ml of starch indicator was added to the respective fruit sample solution. The samples were titrated with 5.0 and 5.1cm iodine solution respectively. The end point of the titration was identified as the first permanent trace of a dark blue-black colour due to the starch-iodine complex. The titrations were repeated with further aliquots of the sample solution until concordant results (titres agreeing within 6.0 and 5.1cm) were obtained.

RESULTS

Table 1 shows the results of proximate composition of *Solanum lycopersicum* (tomato) fruit. These include those of the moisture, ash, fibre, lipid, crude protein and carbohydrate contents. The study revealed that *solanum lycopersicum* has higher concentrations of ash, lipid and crude protein. Table 2 shows the phytochemical screening of *solanum lycopersicum* fruit. It revealed the presence of cardiac glycosides in only petroleum either extract of tomato, presence of saponins in only the water extracts of tomato, presence of polyphenols and reducing sugars for both water and petroleum ether extracts of tomato. Table 3 shows the readings of the titrations of the sample solutions. The results gotten after taking the average or mean of the titres for fruit sample solutions shows the iodine intake of tomato.

Table 1: The Result of Proximate Compositions of the *Solanum lycopersicum* fruits

S/N	Parameters	%
1.	Moisture content	26

2.	Ash content	10
3.	Fibre content	12
4.	Lipid content	12
5.	Crude protein	16.1
6.	Carbohydrate content	49.90

Table 2: The Result of Phytochemical Screening of *Solanum* lycopersicum

Fruits/solvents	Cardial glycosides	Alkaloids	Saponins	Tannin	Flavonoids	Polyphenols	Reducing compounds	Phlobatannins	Anthranoids	Anthra-quinones
Tomato (pet. Ether)	+	-	-	-	-	+	+	-	-	-
Tomato (water)	-	-	+	-	-	+	+	-	-	-

Key: + =Available, - = Not Available or not detected

Table 3: The Readings of Titration for Determination of Ascorbic Acid in Tomato

Burette Reading	**1st**	**2nd**	**3rd**
Initial Reading	0.00	7.00	13.00
Final Reading	5.10	12.10	18.0
Vol. of iodine	5.10	5.10	5.00

Average titre = Mean of the volume of iodine used.

DISCUSSION

The moisture content of tomato is 26% for tomato. Moisture content of food is usually used as a measure of stability and the susceptibility to antimicrobial contamination (Scott, 1980). The ash content of tomato is 10% indicting that the ash content in tomato is high. The high ash content of the tomato shows that minerals are likely to be concentrated in tomato. The result of analysis for test of crude fibre content tomato is revealed 12%. Fibre helps in the maintenance of human health and has been known to reduce cholesterol level in the body. The lipid contents of tomato revealed 12% of tomato. The fat content of tomato is low. Fat is monosaturated, it is considered healthy when consumed on moderation. Lipids are essential because they provide the body with maximum energy. Fruits with high lipid contents are usually compared with those of soya bean oil, locust bean and cotton seed; 19.10g/100g, 20.30g/100g and 14.05g/100g crude fat respectively. These are commercially exploited and classified as oil seed (Ayodele, 2000).

The test result for the analysis of tomato shows that crude protein is 16.1%. The tomato has a reasonable amount of protein. Proteins are essential component of diets needed for survival of animals and humans; their basic

function in nutrition is to supply adequate amounts of required amino acids. Protein deficiency causes growth retardation, muscle wasting, abnormal swelling of the belly and collection of fluids in the body (Zarkada and Vodeng, 1997). The daily protein requirement for children and adult is 23-25g and 45-56g respectively (NRC, 1974). The carbohydrate content of tomato as shown in table 1 is 49.9% respectively. This is moderate in tomato, and showed that carbohydrate is rich and can serve as a good source of energy. When carbohydrate is deficient in food it prevents the unnecessary usage of protein and allows it to be used for body building processes.

The result of phytochemical screening of the tomato is presented in table 2. The results of phytochemical screening of tomato revealed the presence of cardiac glycosides, saponins, polyphenols and reducing sugars while alkaloids, flavonoids, tannins, phlobatannins, anthranoids and anthraquinones are absent. Most cardiac glycosides are toxic and may have pharmacological activity especially in the heart. It has been used as arrow poison of drugs and therapeutically to strengthen a weakened heart make it work efficiently (Trease and Evans, 1996). (Manfred, 2002). Analysis of phytochemical screening of saponins for petroleum ether and water extracts of tomato and result obtained shows that saponins was present in the water extracts of tomato fruit and absent in the petroleum ether extract of tomatoes. Saponins have medical uses and they possess an outstanding characteristic that is; the solution froth greatly. This is the reason for their use as detergents and it explains its name (Sapo in Latin meaning soap). The results of phytochemical screening of tomatoes shows that polyphenols are present in abundance in both petroleum ether and water extracts of tomato. polyphenols are compounds that have a hydroxyl group directly attached to a benzene ring. They are structurally similar to alcohol but are much stronger acids (Solomon and Craig, 1998). It helps in contracting the blood capillaries and also prevents certain hemorrhages. The result obtained shows reducing sugars was present in moderate quantities in both extracts of water and petroleum ether of tomato.

Ascorbic Acid

The result of the various titre values for tomatoes are presented in table 3 respectively.

CONCLUSION

This project work presents an insight to the various macronutrient contents, the concentration of ascorbic acid and the various medicinal components of the various commercial fruit (tomato) that was analyzed. These information and data obtained from determining the level of ascorbic acid, macronutrients and phytochemical analysis, are needed by nutritionists, dieticians and doctors, who are involved in attending to people who need their services in health and dietary planning. Extreme health challenges especially those suffered as a result of lack of vitamin C and malnutrition can lead to a permanent deformity or even death.

REFERENCES

1 Ayodele JT, Alao OA, Olagbemiro TO (2000). The Chemical Composition of Sterculia setigera. Trop. J. Anim. Sci. 3(2): 69-76.

2 Galeotti, F., Barile, E., Curir, P., Dolci, M., Lanzotti, V. (2008), Flavonoids from carnation (Dianthus caryophyllus) and their antifungal activity. Phytochemistry letter 1: 44-48

3 Harish, K., Purvi, K. (2011), Anthracene glycosides and amp. Tannins 6: 88. Retrieved from http://www.scribd.com/mobile/doc/60971792/Glucosid es - amp- Tannins-part-6.

4 Kittakoop, P., Mahidol, C., Ruchirawat, S. (2014). Alkaloids as important scaffolds in therapeutic drugs for the treatment of cancer, tuberculosis and smoke cessation, Curr. Top. Med. Chem. 14(2): 239-252.

5 Kochhar. S L. (1988). In economic botany in the tropical S. L. Kochhar (Ed). New delhi Macmillan company Publishers, India.
6 Manfred, H. (2002), Alkaloids nature's curse widely vet. ISBN 978-3-906890-34-6
7 Morton, Julia F. 1987. Fruits of warm climates. Publ. by the author, Miami, FL. xii, 505 p.
8 NRC (1974). National Research Council. Recommended daily allowances. Washington DC. United States Nutrition and Medicinal Board. National Academy of Science
9 Singh, B., Rastogi, R P. (1970). Cardenolides-glycosides and genins. Phytochemistry 9: 315-331.
10 Sofowora E. A. (1984). Medicinal plants and traditional medicine in Africa IIe-Ife. University of Ife Press.
11 Solomons G. & Craig F. (1998). Organic chemistry, New York; John Wiley and Sons, Inc.
12 Trease G. E. & Evans W. C. (1996). Pharmacognosy. London, Casell and Coller. Macmillan Publishers. Trease G. E. & Evans W. C. (1989). Trease & Evans' Pharmacognosy. 13th Edition. London: Bailliere Tindale. p. 832
13 Zarkada, C. G. & Voldeng, H. D. (1997). Determination of the protein quality of three new Northern adapted cultivars of common and mico type soya beans by amino acids analysis. J. Agric. Food Chem. 45:1161-1168