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Effect of partial processing and drying (at various temperatures) on the levels of some nutrients of Tomato (*Lycopersicon esculentum*)

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ABSTRACT: Tomato paste was boiled for one hour and dried at various temperatures, the effect of temperature on the ascorbic acid, protein, fat and sugar content of the peeled and unpeeled dried tomato was determined.

Ascorbic acid and protein were significantly affected by temperature. Fat and sugar were not significantly affected by the various temperatures. The paste was also treated with 3% metaphosphoric acid and the effect of metaphosphoric acid on the ascorbic acid, protein, fat and sugar content of the peeled and unpeeled dried tomato samples determined. Results showed treatment with metaphosphoric acid significantly preserved the ascorbic acid content of the dried tomato but significantly reduced the protein content of the tomato. Sugar and fat were not affected by temperature and were insignificantly ($P>0.05$) affected by 3% metaphosphoric acid.

Key Words: Tomato; *Lycopersicon esculentum*; Ascorbic acid; Processing techniques.

Introduction

The production and distribution of fruits and vegetables in Nigeria is seasonal especially in the case of tomatoes. This fluctuates with season of abundance and scarcity. In addition, the seasonal market in between the major producing zones and consuming areas affects its availability. The prices of these items escalate in times of scarcity and the situation is compounded by the lack of appropriate technology for preservation.

In developed countries, fresh tomatoes are normally processed and stored in the form of canned tomatoes or stored in the form of juice, ketchup or puree at a temperature of 20°C for at least a period of 6 months (Stone, 1982). However, technologies are beyond the reach of poor Nigerian farmers. The traditional methods of preserving tomatoes vary from one part of the country to another. In Borno State for instance which according to FAO (1987) report represents 10% of the world's production of tomatoes, tomatoes are normally sliced into equal portions and sundried. The tomatoes are sometimes treated with a solution of potash (Kanwa) before sundrying to improve the product quality. After drying, it is then packed into a bag and stored. This method of storage makes it susceptible to spoilage and tends to affect the ascorbic acid content of the tomatoes. In addition, local preservation methods lead to enzymic browning

and loss of the tomato flavour both of which are responsible for the loss of aesthetic appeal for dried tomato. Hence the need for a better method of preserving tomatoes becomes necessary.

The rapid increase in human population in Nigeria outstrips that of food production particularly fruit and vegetables. Although, if the quality usually lost can be preserved, it will help considerably to adjust the widening gap and alleviate hunger tremendously in the country. In Nigeria, tomatoes can represent a symbol of the ills of handily fruit produce. A consumer survey of 31 items comprising apples, oranges, bananas, guava, tomatoes, pepper, amaranthus, pawpaw etc. revealed greatest lose in tomatoes (Handy and Ptaff, 1975). As a result of poor and inadequate transport facilities to convey the produce from the production areas to the urban markets, between 30-50% are lost during the post harvest period (Olorunda and Aboaba, 1978). The post harvest losses quality charges of tomatoes which are often accepted in Nigeria as hazards of nature beyond human control could be minimized by a better method of preserving tomatoes.

Fruits and vegetables constitute the bulk of daily food intake in many Nigerian homes. According to Davidson (1979), fruits and vegetables are acclaimed as protective foods usually because they contain essential nutrients such as vitamins, minerals and proteins. They also provide variety, bulk and taste to our diets and thereby stimulate interest and aesthetic appeal. There is therefore an urgent need to increase the aggregate supplies for the consumers and an easier way to achieve this is by reducing the physical losses associated with quality charges in tomatoes. Although consumers have shown keen interest in tomatoes, very little research appears to have been carried out in Nigeria especially on the preservation of tomatoes in a dried form with minimal loss of essential nutrients colour and taste.

Materials and Methods

Tomatoes used for this study was locally obtained from Monday market, Maiduguri.

Procedure:

The tomatoes were divided into four equal portions having the same weight.

(i) One portion was scalded by putting the tomatoes in boiling water for one minute followed by subjecting it to cold water to crack the skin. The tomatoes were then peeled and blended. The paste was then boiled for one hour until only a residual moisture content of 5-7% remained. The weight of the sample was taken and dried at various temperature 40°, 60° and 80°C). A portion of the sample was sundried. The vitamin C, protein, sugar and fat content of the samples were then determined after a period of 3 months.

(ii) The second portion of the tomatoes was blended without peeling. Boiling was done for 1 hour until a residual moisture content was between 5-7%. The paste was then dried at various temperatures (40°, 60° and 80°C). A portion was then sundried. Vitamin C, sugar, protein and fat content were determined after 3 months of storage.

(iii) The third portion of the tomatoes was also scalded by putting in boiling water for 1 minute and then peeled. It was then blended with 200ml of 3% metaphosphoric acid in order to prevent ascorbic acid oxidation. Boiling was done for 1 hour till only a residual moisture content of 5-7 remained. Drying was done at various temperatures (40°, 60° and 80°C). A portion was also sundried. The vitamin C, protein, sugar and fat content of the samples were determined after 3 months of storage.

(iv) The fourth portion of the tomatoes was blended with 200ml 3% metaphosphoric acid without peeling. Boiling was done for 1 hour, followed by drying at various temperatures (40°, 60° and 80°C). A portion was sundried and vitamin C, protein, sugar and fat determined after a period of 3 months.

Reduced ascorbic acid determination

One group of the dried sample was dissolved in 100ml of water then filtered through Whatman No. 4 filter paper into a clean conical flask. 2,6-dichlorophenol indophenol dye was then titrated against 5ml of the aliquate pipetted into a clean 250ml conical flask until a rose pink colour which persisted for 15 seconds was obtained.

Estimation of protein by Nesslerization

Dried samples (1.0g) were weighed into four different digestion flasks and digestion tablets added. 3ml sulphuric acid was then added to each sample. The digestion flasks were set up in the digestion rack and heated for a prolonged period of time until sample was completely digested. The flasks were then cooled at room temperatures and diluted with distilled water to 100mls. 1ml of each diluted digest was taken in four different test – tubes and 2-5mls of distilled water, 5ml of 7.5% NaOH were added followed by 1ml gumphatti. 1ml of Nesslers reagent was finally added and the optical density reading taken at 520nm. Ammonium sulphate was used as a standard in all the determination.

Determination of reducing sugar by directs weighing methods.

Reduced copper in the form of Cu_2O was insoluble and the amount was gravimetrically determined after filtration. 50ml of the soxhlet reagent (25ml $CuSO_4$ and 25ml k-Natartrate) and 50ml sugar solution in a beaker were boiled for 4 minutes and filtered. The precipitate (Cu_2O) was transferred to a gooch crucible with asbestos pads and dried to a constant weight. The sugar equivalent was determined by the weight of Cu_2O from the Hammond table.

Fat estimation

Three grams of the dried sample was taken into four different filter paper thimbles which were previously weight together with a small piece of cotton wool. The quick fit tube into which the thimble was been introduced was fitted into a round bottom flask and attached to the tube in a condenser. The round-bottom flask was heated in water bath. The extraction procedure was carried out for 1 hour for each sample. The thimble was then removed and dried in an oven at 70°C. The amount of fat extracted was obtained from the differences in weight between the thimble and its content before and after extraction.

Results

Mean percentage ash content of the peeled sample is 4.08 ± 0.22.

Table 1: Percentage moisture content of the dried samples.

Temp. °C	Peeled untreated	Unpeeled untreated	Peeled treated	Unpeeled treated
80	2.00 ± 0.12	1.96 ± 0.08	1.98 ± 0.10	2.00 ± 0.03
60	2.00 ± 0.25	2.03 ± 0.13	1.90 ± 0.09	2.00 ± 0.21
40	1.90 ± 0.15	2.03 ± 0.02	2.00 ± 0.11	2.01 ± 0.11
Sun dried	2.00 ± 0.20	1.90 ± 0.23	1.90 ± 0.09	1.90 ± 0.07
(Stored) fresh sample	92.14 ± 0.43	92.15 ± 0.56	92.16 ± 0.33	92.12 ± 0.60

All values are Means ± S.D for Triplicate determination.

Table 2: Mg vitamin C/100g dry samples (Untreated).

Temp. °C	Peeled untreated	Unpeeled untreated
80	4.00] 0.08	2.960 ± 0.3
60	5.00 ± 0.55	4.00 ± 0.20
40	2.00 ± 0.10	1.70 ± 0.17
Sun dried	5.60 ± 0.11	4.00 ± 1.50
fresh (Wet) Stored	2.22 ± 0.02	2.00 ± 0.33

All values are Means ± S.D. for triplicate determination.

Table 3: Mg vitamin C/100g of samples treated with 3% metaphosphoric acid.

Temp. °C	Peeled untreated	Unpeeled untreated
80	6.00 ± 0.03	3.00 ± 0.35
60	16.66 ± 0.55	6.60 ± 0.55
40	5.00 ± 0.35	5.00 ± 0.24
Sun dried	13.60 ± 0.30	6.70 ± 0.60
Fresh (Wet) Stored	6.25 ± 0.06	5.71 ± 0.04

All values are Means ± S.D. for triplicate determination.

Table 4: Mg protein/g of dried samples.

Temp. °C	Peeled untreated	Unpeeled untreated	Peeled treated	Unpeeled treated
80	2.00 ± 0.12	5.46 ± 0.25	3.63 ± 0.10	1.74 ± 0.26
60	2.00 ± 0.25	10.98 ± 0.17	4.22 ± 0.38	3.72 ± 0.34
40	1.90 ± 0.15	10.75 ± 0.18	3.37 ± 0.36	2.00 ± 0.09
Sun dried	2.00 ± 0.20	11.92 ± 0.48	4.22 ± 0.38	2.31 ± 0.16
Fresh (Stored	12.42 ± 0.04	12.52 ± 0.30	9.94 ± 0.30	8.40 ± 0.52

All values are Means ± S.D. triplicate determination.

Table 5: Shows the percentage fat content of the samples.

Temp. °C	Peeled untreated	Unpeeled untreated	Peeled treated	Unpeeled treated
80	1.140 ± 0.001	1.145 ± .005	1.140 ± .003	1.140 ± 0.005
60	1.145 ± 0.005	1.150 ± .041	1.140 ± .003	1.140 ± 0.003
40	1.140 ± 0.003	1.50 ± .041	1.140 ± .003	1.145 ± 0.005
Sun dried	2.150 ± 0.004	1.50 ± .005	1.145 ± .005	1.145 ± .005
Fresh (Stored)	1.145 ± 0.005	1.145 ± .005	1.140 ± .005	1.150 ± .004

All values are Means ± S.D. for triplicate determination.

Table 6: Percentage reducing sugar in all the samples.

Sample	Sugar	80°C	60°C	40°C	Sun dried	Fresh (Stored)
Peeled	Glucose	15.60 ± 0.38	15.50 ± 0.38	15.60 ± 0.38	15.60 ± 0.38	15.60 ± 0.38
untreated	Fructose	17.12 ± 0.52	17.12 ± 0.52	17.12 ± .052	17.12 ± 0.52	17.12 ± 0.52
	Invert sugar	16.40 ± .019	16.40 ± .019	16.40 ± .019	16.40 ± .019	16.40 ± .019
Unpeeled	Glucose	19.61 ± 0.68	19.61 ± 0.68	19.61 ± 0.68	19.61 ± 0.68	19.61 ± .068
untreated	Fructose	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66
	Invert sugar	20.60 ± .016	20.60 ± .016	20.60 ± .016	20.60 ± .016	20.60 ± 0.016
Peeled	Glucose	15.60 ± 0.38	15.60 ± 0.38	15.60 ± 0.38	15.60 ± 0.38	15.60 ± 0.38
treated	Fructose	17.12 ± 0.52	17.12 ± 0.52	17.12 ± 0.52	17.12 ± 0.52	17.12 ± 0.52
	Invert sugar	16.40 ± 0.019	16.40 ± 0.019	16.40 ± 0.019	16.40 ± 0.019	16.40 ± 0.019
Unpeeled	Glucose	19.61 ± 0.68	19.61 ± 0.68	19.61 ± 0.68	19.61 ± 0.68	19.61 ± 0.68
treated	Fructose	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66	21.52 ± 0.66
	Invert sugar	20.60 ± .016	20.60 ± .016	20.60 ± .016	20.60 ± .016	20.60 ± .016

All values are Means ± S.D. for triplicate determination.

Discussion

The moisture content of the dried tomatoes observed in this work averaged 2%. This agrees with the findings of Mudahar *et al*., (1986). The moisture content is not sufficient for microbial growth to occur. Low ash content was observed in the unpeeled samples probably due to the evaporation of volatile compounds in the peel and seed that evaporates on heating. Ascorbic acid content of the tomato was affected by temperature. Samples dried at 80°C contained little ascorbic acid. However, both sun dried sample and samples dried at 60°C retained much of their ascorbic acid. A decrease was however observed

in samples stored in refrigerator and sample dried at 40°C. The decrease may be due to oxidation of the ascorbic acid over a long period of time (Canthy, 1989). Samples treated with 3% metaphosphoric acid tended to retain their ascorbic acid than samples that were not treated with metaphosphoric acid. Results also showed that peeled samples have significantly higher ascorbic acid ($P<0.05$) than unpeeled samples dried at 60°C and sun dried. This probably is due to non-enzymic oxidation of the ascorbic acid which may have been enhanced by compounds in the peel, especially sugars which is present in high concentration in the peels than the locules (Widzich, 1984).

There was however no change in the amount of reducing sugar in all the samples at various temperatures. Treatment of the tomatoes with 3% metaphosphoric acid had no effect on the sugar content of the dried samples. However, significant difference was observed in sugar levels between peeled and unpeeled samples indicating that the removed of the peel decreases the sugar content of the tomatoes. The lipid content of the tomatoes was not affected by temperature and treatment with 3% metaphosphoric acid. There was significant difference in protein content ($P<0.05$) of peeled samples treated with 3% metaphosphoric acid and samples that were not treated. samples not treated with metaphosphoric acid had higher protein content than samples treated. However the difference between the protein content of peeled and unpeeled samples was not significant ($P>0.05$). This indicates that metaphosphoric acid depletes the protein content of tomatoes. This may be due to the reaction of amino groups of proteins and volatile compounds that react with ribose and phosphoric acid to form mutagenic compounds by cross-linking reactions. Such mutagenic compounds impair the digestibility of proteins and the availability of amino acids as reported by Carthy, 1989.

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