

Post Harvest Losses Reduction of Tomatoes (*Lycopersicon esculentum* L) Stored in Natural Preservatives

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ABSTRACT--- Preservation practised in the food industry always involves the use of combination methods for achieving maximum effectiveness. Chemical preservatives are carcinogenic with high residual toxicity. Botanicals could therefore have advantages over synthetics as a cost effective and environmentally sustainable, alternative for protecting stored produce.

The study assessed the nutritional and shelf life changes in wholesome Tomatoes (*L. esculentum*) stored in aqueous extracts of thyme (*Thymus vulgaris*), garlic (*Allium sativum*), ginger (*Zingiber officinale*), *Eugenia clove* (*Eugenia aromatica*) and salt. The mean values for the proximate analysis were Vitamin C 18.0 ± 0.5 mg/100g, Total soluble solids 6.5 ± 0.5 , Total reducing sugar 2.45 ± 0.01 mg/100g, Total titratable acidity $0.99 \pm 0.05\%$, Soluble protein 2.5 ± 0.06 and Ash content 0.30 % at the end of sixth month. Values of all parameters decreased throughout the storage period except titratable acidity. These parameters were monitored for a period of six months. All parameters analysed were significantly different ($P \geq 0.05$). The results for sensory evaluation were rated high for four months. The storage duration was six months for ambient and eight months for refrigerated experimental samples.

Keywords--- Tomatoes, proximate analysis, shelf life, natural preservatives, sensory evaluation.

1. INTRODUCTION

Tomatoes (*L. esculentum* L) thrive well in savannah region (Northern Nigeria) than in the tropical south. Tomatoes are highly perishable vegetables. Tomatoes are mainly ingredients for stew, sauces of African dishes and salad. Bountiful harvest only last a short while, if proper steps are not taken to preserve them. It has been reported that 30-70% of tomatoes produced in Nigeria were wasted (Aworh, 1991). Losses are encountered immediately after harvest, transit, markets until it reaches consumers. Storage of wholesome fresh tomatoes technology is not available in Nigeria. Hence Nigeria spends Billions of Naira to import tomato paste every year (Adesina, 2012). Synthetic chemical preservatives are expensive and unavailable. In this study spices which are historically flavour enhancer and antimicrobial in medicine, food and drugs were used. Plastic jars were used in this study as they are readily available and Canning technology not available in Nigeria. Citric acid preservatives are usually used in imported canned peeled tomatoes. Spices / herbs such as Thyme, garlic, ginger and eugenia clove water extract were used in study. Given the human health and pollution problems associated with use fungicide, wax and other chemical treatments. Trends towards the use of "NATURAL GREEN", in various food and beverages industries are gaining momentum (Shilpi Gupta and Nissreen, 2011; Adekalu *et al.*, 2009; Audu Barnett, 2011).

Vegetables apart from providing nutrition, contribute to the appetizing colour, texture and flavour. Bountiful harvest only last a short while if proper steps are not taken to preserve them. Uneducated big time farmer in Bauchi state called for storage of tomatoes in silos (Audu, 2010). Post harvest begins at the moment of separation of the edible commodity from plant or tree by deliberate human act, with the intention of starting it, on its way to table. Surplus cannot be stored for sale in the off season because of inadequate storage facilities and technology, hence, the need for research breakthrough to minimize or reduce losses of fruits and vegetables. Post harvest research has significant contribution through research on the physiological changes of the produce, storage, new long life varieties, and control of ripening, suitable cultivation methods, and optimum harvesting indices, storage recommendations, pre-cooling, refrigerated transports and careful handling. The continuous search for plants products for use as medicines is encouraged by ethno-botanical survey as one of the major approaches for selecting plants for pharmacological screening (Adekunle, 2001; Ajaiyeoba, 2006). In ancient times herbs and spices are used to preserve food. Investigation of plants biological active compounds began in the early 20th century (Beye, 1978). Botanical such as Neem and hot chilli have been used from generations throughout Africa, Asia and America (New Agriculturist, 2003). Botanicals could therefore have advantages over synthetics as a cost effective and environmentally sustainable, alternative for protecting stored produce. Consumers tend to have suspicious of chemical additives and thus exploration of naturally occurring antimicrobials for food preservatives

receives increase attention (Nychas, 1995). Many plants derived products such as spices, fruits or vegetable preparation or extracts have been used for centuries for the preservation and extension of shelf life of food (Chattopadhyah and Bhattacharya; 2007). Most homes in this part of the world do not have access to regular electricity. Canning technology and processing of fruits and vegetables are not available. It is therefore difficult to store fresh fruits for more than a week. . In this study, proven spice namely *Thymus vulgaris*, *Eugenia aromatica*, *Allium sativum*, and *Zingiber officinale* were used to extend shelf life of wholesome *Lycopersicon esculentum*.

2. MATERIALS AND METHODS

2.1. Collection of Materials

Firm, ripe wholesome tomatoes (Roma variety) were purchased from Ketu Lagos markets. Dried thyme, garlic, ginger and eugenia clove were also purchased. Tomatoes were sorted and washed.. Dried thyme, garlic, ginger and eugenia clove were also sorted out weighed and ground with blender.

Known weights (3:3:3:2:1) of the dry spices and salt were dissolved in sterile water and boiled were then filtered. Plastics jars of 500cm³ capacity were washed properly in clean soap rinsed thoroughly with water and drained.

2.2. Experimental Setup

300 grams of scalded tomatoes were packed in 500cm³ plastic jars, 300mls of prepared extracts.

Ten jars containing scalded tomatoes and spices extracts together with control were steamed in a steamer for 10 - 15minutes. The jars were left on shelf (Ambient). Shelf life studies were monitored for six months.

2.3. Assessment of the Physico-Chemical Parameters

Data of the physico-chemical parameters were collected on a monthly interval until deterioration sets in. Physical parameters: These include colour, taste, and aroma.

2.4. Biochemical Analysis

pH Measurement

Ten grams of the sample at monthly intervals was added to 100ml of sterile distilled water. The sample was homogenised and centrifuged at 5,000 rpm for 30 minutes, the supernatant was then decanted, and the pH was determined using pH meter.

Total titratable acidity (TTA) was determined as described by Pearson (1976).

ASH Content Determination

Five grams (5g) of the sample was weighed into a porcelain crucible, previously ignited and weighed. Organic matter was charred by igniting the material on a hot plate in the fume cupboard. The crucible was later placed in the muffle furnace and maintained at 600C for six hours. It was then cooled in a desiccator and weighed immediately. The percentage ash was calculated

$$\text{Ash (\%)} = \frac{\text{ash weight (gm)} \times 100}{\text{sample weight}}$$

Vitamin C (Ascorbic acid) Determination as described by AOAC (1990)

Total reducing sugar determination as described by McCasady (1971) and Dubious *et al.*, (1956)

Soluble protein and Total soluble solids were determined as described by (AOAC 1990)

Sensory Evaluation was determined visually. Parameters like appearance, colour, firmness, and taste were graded using Hedonic scale: 5 = very good, 4 = good, 3 = fair, 2 = poor and 1 = bad.

Evaluation was assessed by ten panellists who are familiar with sensory assessment.

2.5. Data Analysis

All data obtained was subjected to analysis of Variance (ANOVA) and separation of means using a pre package computer soft ware using SAS statistical package.

3. RESULTS AND DISCUSSION

The results of the biochemical analyses is presented in Table 1. There was gradual increase in Ph values from 4.15-6.7.. Tomato is originally acidic in nature. There was a steady decrease of ash content ($0.56\pm 0.02 - 0.30\pm 0.06$). The result of the soluble protein decreased significantly ($P\leq 0.05$). Mean values ranged from $3.87 \pm 0.04 - 2.5\pm 0.06$). These values were in accordance Milad (1969) report, that processing of fresh tomato juice at 220°C for 20 minutes. Soluble protein can be denatured due to partial hydrolysis. Vitamin C values ranged from $23.3\pm 0.57 - 18.0\pm 0.5\text{mg}/100\text{g}$. Nutritive value of processed tomato products depend both on the initial content. Vitamin C necessary for normal metabolism, wound healing and collagen synthesis is associated by consumers of tomato product. It is evident from literature that a good deal of ascorbic acid may be lost during processing. Values of reducing sugar contents also decreased slightly between $2.8\pm 0.05 - 2.45\pm 0.01\text{mg}/100\text{g}$. Value of soluble solids ranged between $7.69\pm 0.15 - 6.5\pm 0.05\text{mg}/100\text{g}$. Values of the titratable acids increased slightly ($0.84\pm 0.05 - 0.99\pm 0.05$). The acid in tomatoes is generally citric acid. Processing and storage of the finished products affects nutrient concentration. All parameters analysed decreased throughout the period of storage. The decreases in all nutritive parameters were consistent with reports of Lopez and Williams, 1981; Idah *et al.*, Ejechi *et al.*, 2008 and Adekalu, 2014)

Table 2 shows that the appearance, colour were graded “very good” for four months, firmness graded, very good for three months. At the end of six months they were rated fair. Fresh and preserved tomato total soluble solids, soluble protein, pH decreases during the study only titratable acidity increased.

The nutritive value of processed tomato products depend on both the initial concentration of fresh and effect of processing and type of storage on the finished products.

Losses occur at every stage of the food supply chain from the moment of harvesting, during handling, storage, processing and marketing.

The result of this study is in agreement with Ejechi (2008) who reported that combination of mild heat and mixtures of aqueous extract of *Zingiber officinale* and *Aframonium meleguet* extracts markedly reduced bio-deterioration of fresh Okra as indicated by a little loss of carbohydrate after three months of storage. Spices may be economically important in the application of hurdle technology.

Temperature of storage is extremely important to retention of nutrient in tomato products, Since tomato products are usually held in warehouses that are not refrigerated, the vitamin concentration will be less than in the fresh or immediately after processing. To maintain levels at or above that of fresh tomatoes, fortification of tomato products was proposed.

4. CONCLUSION

Preservation of wholesome scalded tomatoes in natural preservative is a promising research project. In developing countries where electricity is not stable and no agricultural chemical industries, this project can be introduced to farmers and marketers. Also, it is a value addition to the large harvest, transportation, processing and consumption of tomatoes.

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Table 1: Proximate analysis, percentage of contents, pH and titratable acidity of t

omatoes stored in local spices.(Mean values)

Month	TSS	Vit C mg/ml	TRS mg/ml	TTA %	Soluble protein	Ash %	pH
0	7.69± 0.15	23.30±0.57	2.89±0.05	0.84±0.20	0.56±0.02	3.8±0.46	3
1	7.07±0.02	22.00±1.00	2.82±0.025	0.82±0.43	0.53±0.01	3.7±0.06	4
2	6.86±0.06	20.60±0.57	2.50±0.05	0.92±0.05	0.46±0.15	3.55±0.05	4
3	6.16±0.10	20.30±0.57	2.50±0.10	0.98±0.11	0.44±0.22	2.91±0.02	4
4	5.26±0.30	18.66±0.57	2.10±0.10	0.98±0.70	0.36±0.05	2.09±0.90	4
5	4.56±0.49	18.33±0.57	1.76±0.15	0.99±0.11	0.30±0.66	1.18±0.14	4
6	3.47±0.05	17.33±0.37	0.91±0.07	1.06±0.05	0.25±0.10	1.13±0.05	4

Values are means ± standard deviations of triplicate determinations (P > 0.05)

Table 2: Sensory Evaluation

Month	Appearance	Colour	Firmness	Taste
0	5	5	5	5
1	5	5	5	5
2	5	5	5	5
3	5	4	4	4
4	5	4	4	4
5	4	4	4	4
6	3	3	3	3

Hedonic scale: Very good = 5, Good= 4, Fair= 3, Poor= 2, Bad= 1