DETERMINATION OF SHELF LIFE AND VITAMIN C CONTENT OF HOME MADE TOMATO PASTE

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ABSTRACT

Post harvest loses are major challenges faced by farmers in general. In view of this, ripe, firm and matured tomato fruits were locally processed into paste by blending ripe tomato fruits into slurry after blanching. The slurry was boiled at 100°C until thickened to form tomato paste, which was divided into 4 samples; A, B, C and D. The samples were stored and preserved under different conditions in order to identify the most suitable method of preservation. The sample stored at ambient temperature was labeled Sample A; at refrigerated temperature (Sample B), Paste with salt at ambient temperature (Sample C) and Paste with vegetable oil at ambient temperature (Sample D). Shelf life was observed by observing the growth of fungi initiation, while Vitamin C contents were determined by AOAC method. Sample B had the longest shelf life of 20 days before sign of spoilage was initiated while other samples got spoilt within 3 days. On the first day of production of the paste, Vitamin C content was 16.0mg/100g as against 17.8mg in commercially produced paste, whereas the contents after day 2 reduced to 11.0mg, 15.0mg and 12.5mg in Samples A, B and D respectively. There was no noticeable Vitamin C in Sample C. while vitamin C content in Sample B (15.0mg) was steady after 5, 10 and 15days of storage in refrigerated temperature. The study concluded that, home-made tomato paste stored under refrigerated condition favoured the shelf life and Vitamin C content. Refrigeration is largely dependent on electricity; therefore constant electricity supply will be needed for preservation of home-made tomato paste.

Keywords: Tomato, Tomato paste, Preservation, Shelf life, Vitamin C.

INTRODUCTION

Tomato, which is botanically a fruit, is also considered a vegetable for culinary purposes and known in the scientific name as *Solanum lycopersicum*. It belongs to the family solanaceae (night shade family). Tomato is a popular and versatile food that comes in over a thousand different varieties that vary in shape, size, and colour such as Cherry tomatoes, Roma tomatoes (India hybrid), Heirloom

tomatoes, Plum tomatoes, Beefsteak tomatoes, Grape tomatoes, Campari tomatoes among others (Aldrich, 2010).

Ripe tomatoes are red or orange in colour and slightly soft to the touch. Tomatoes for fresh market are under ripened and packed in crates to avoid damage while those for canning should be fully ripe. Fully ripe tomatoes can stay for 3-4 days under ambient temperature or longer when stored in the refrigerator but it is best kept at room temperature. Tomato stored cold will still be edible but tend to lose flavour (National Food Institute, 2009).

In Nigeria today, post harvest loses are major challenges. Post harvest loses in quality and quantity are related to immaturity at harvest, inadequate initial quality control, incidence and severity of physical damage, exposure to improper temperature and delay between harvest and consumption. Shortening the time between harvest and consumption can minimize loss of the characteristic tomato aroma and development of off- flavour. There are many farmers growing tomatoes for people's daily need, and research has shown that due to absence of proper post-harvest management system, a bulk quantity of tomato produce gets damaged during the process of handling, transportation and marketing; resulting in 10-25 per cent annual losses (Jorhat, 2005).

Tomatoes are loaded with all kinds of health benefits for the body. One of the most well-known tomato eating benefit is its Lycopene content. Lycopene is a vital anti-oxidant that helps in the fight against cancerous cell formation; protect people from heart attack and have a very beneficial effect on the prostate. It has also been associated with decreased risk of breast cancer, head and neck cancer and might be strongly protective against neurodegenerative diseases (Palozza et al., 2010; Reboul et al., 2005). Other remedies incorporating tomatoes are for rheumatism, severe headaches, burns, scalds, sunburn and toothache (Ithaca, 2002). Tomatoes are also rich in vitamins A and C, Calcium and Phosphorous (Aldrich et al., 2010).

Various attempts have been used at homes to preserve fresh tomatoes, which cannot be consumed within few days of harvest or purchase. The most popular method is to concentrate the tomato into paste. Apart from consumption in raw form, tomato serves as an ingredient in many dishes and sauces and in drinks, it is also used in salads and processed into ketchup, juice, puree and paste or canned whole. Tomato fruit can also be preserved by drying often in the sun in China, sold either in bags or jars with oil or by processing into puree and paste (Anthon et al., 2011).

Tomato paste is reduction of tomatoes that is strained of all seeds and skin. The long hours of cooking thickens tomatoes into a paste by reducing excess moisture. Tomato paste is a source of several nutrients and also features some compounds that are not highly available in raw tomatoes, making it a healthy addition to recipes (Andrea, 2011). Commercially produced tomato paste can last for eighteen months from the date of manufacturing, if stored under recommended conditions (Anthon et al., 2011; Borguini, 2009). Nwanekezi and Onyeali (2005) carried out a study on the effect of storage on the ascorbic acid (vitamin C) content of tomato paste preserved with and without oil. Results showed that the vitamin C content of the tomato paste preserved with oil reduced from 17.00 to 16.60mg/100g from the period of 0-40 weeks. The bacterial count after 40 weeks of storage showed that the paste without oil has a bacterial load of 0.35x104cfu/ml and that with oil has a bacterial load of 0.08x104cfu/ml. Bacillus coagulans and Lactobacillus spp were the pre-dominant micro-organism found in the two samples, while Staphylococcus aureus was present

only in the sample without oil. Amer Mumtaz (2010) carried out a characteristic study of tomato paste stored at different temperature. Result showed that the ascorbic acid content of tomato paste stored at room and refrigerated temperature declined gradually over the period of 240 days of storage.

In view of the importance of converting tomato fruits to tomato paste to avoid post harvest losses, this study was conducted to determine the shelf life and ascorbic acid content of home-made tomato puree preserved by different methods.

MATERIALS AND METHODS

Collection of materials

Matured ripe Roma tomato *(Lycopersicum esculentum)*, oil, salt and the packaging materials were purchased at the Central Market in Ile-Ife, Osun-State. The cooking utensils were got from the Department of Family, Nutrition and Consumer Sciences in the Food and Nutrition Laboratory of Obafemi Awolowo University, Ile Ife, Nigeria. Weighing balance and the reagents and apparatus used for the analysis of ascorbic acid content in the tomato paste was provided by the Department of Food Science and Technology Laboratory of same University.

Production of tomato paste

The tomato fruits purchased were sorted in order to remove bruised and infected ones. Stems, leaves, dirt and other soil which might have accumulated during harvesting and handling were removed. The tomato fruits were washed under running water and blanched for 15 minutes to soften the skin and were allowed to cool. The skin and the seeds were removed and the pulp was made into slurry using the electric blender. The pot used was smeared with a little oil to avoid burning then cooked at 100°C, until moisture evaporated and thickened. After which it was allowed to cool. Figure 1 shows the flow chart of the processing steps.

Determination of shelf life

Processed tomato paste was evenly distributed and packaged in twelve plastic containers to get 85g of each container. The packaged samples were divided into four to form samples A, B, C and D. All the four samples were in triplicates. Three different methods of preservation of the tomato paste were investigated; sample A was paste without any preservative at ambient temperature, sample B was paste without preservative but was at refrigerated temperature, while samples C and D were pastes with 4.5g of salt and 59g of groundnut oil at ambient temperatures respectively. All the samples were subjected to continuous daily observation every twelve hours until physical fungi growth was observed as sign of spoilage.

Determination of Vitamin C (Ascorbic Acid) content

The ascorbic acid content in the tomato paste was quantitatively determined using Association of Official Chemists (AOAC, 1990) method. The tomato paste sample was titrated with iodine; the vitamin C was oxidized by the iodine. When there was no more vitamin C to be oxidized, there was an excess of iodine. The iodine then combined with the starch to make a blue/purple solution. The mass of vitamin C in mg per g of paste or per mL of the sample was calculated and recorded. This was repeated for all the samples at intervals and the mean values were obtained. Data generated were an average of triplicate determinations.

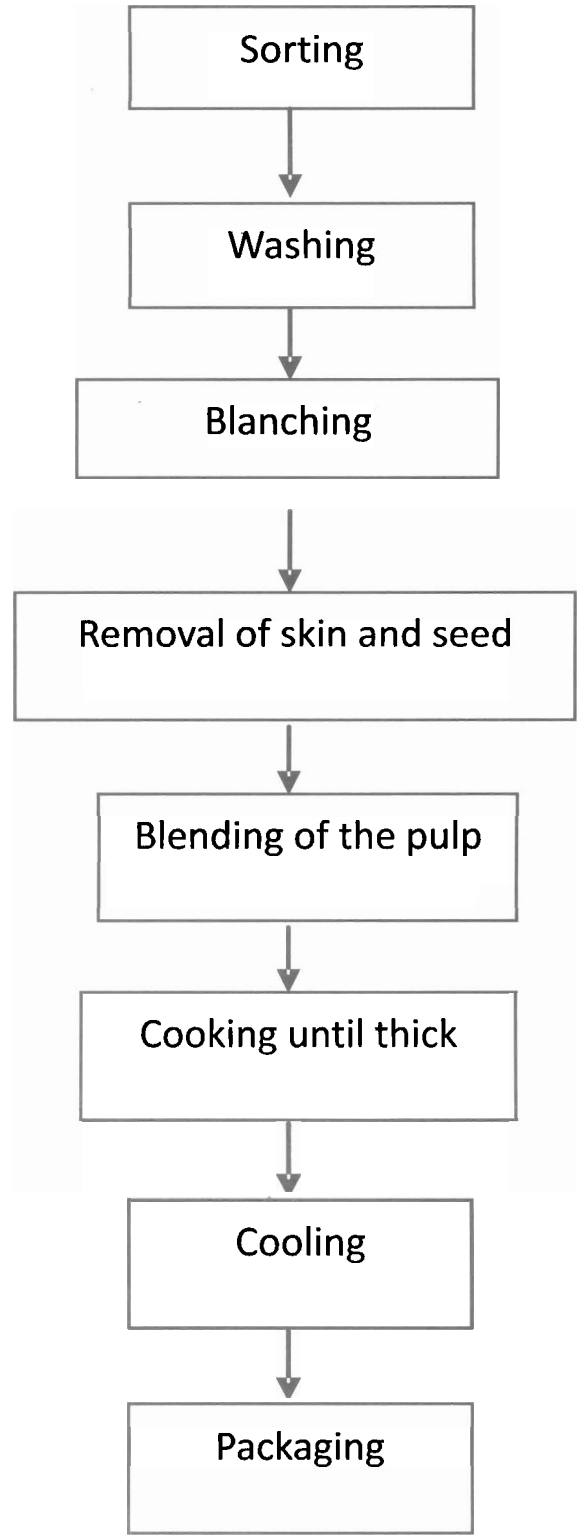

Figure 1: Flow Chart for the Production of Tomato Paste

Results

Shelf life

The shelf life of home-made tomato paste stored at ambient and refrigerated condition and those preserved with salt and groundnut oil have varying length of storage. The results as indicated in Table 1 showed that the tomato paste stored at ambient condition (Sample A) remained in good condition for two days after which oxidation started and growth of fungi was observed on the third day. Sample B (refrigerated) kept for twenty days after which fungi growth was observed on the twenty-fifth day. The tomato puree preserved with salt at ambient temperature (Sample C) remained in good condition for three days and fungi growth was seen on the fifth day. The fourth sample (Sample D) which was preserved with vegetable oil at ambient temperature stayed for two days and spoilage was noticed on the fifth day. Fungi growth was determined by observation at every twelve hours.

Ascorbic acid (Vitamin C) content

Data in Table 2 showed the vitamin C contents of home-made tomato paste preserved by different methods as described in methodology. On the first day of processing the tomato into paste, analysis was carried out and the vitamin C content 16.4mg/100g.

Table 1: Days Fungi growth was noticed on locally produced tomato puree stored at different conditions

Days of storage before spoilage	Puree only at ambient condition (Sample A)	Puree only at refrigerated condition (Sample B)	Puree + salt at ambient condition (Sample C)	Puree + oil at ambient condition (Sample D)
Day 2	No	No	No	No
Day 3	Yes	No	Yes	No
Day 4-15	Yes	No	Yes	Yes
Day 16-19	Yes	No	Yes	Yes
Day 20 - 24	Yes	No	Yes	Yes
Day 25	Yes	Yes*	Yes	Yes

***Longest shelf life**

Table 2: Ascorbic acid content of tomato puree stored and preserved under different conditions at 15 days interval.

Days	Puree only at ambient condition (Sample A)	Puree only at refrigerated condition (Sample B)	Puree + salt at ambient condition (Sample C)	Puree + oil at ambient condition (Sample D)
Day 1	16.0mg	-	-	-
Day 2	11.0mg	15.0mg	-	12.5mg
Day 5	-	15.0	-	-
Day 10	-	15.0	-	-
Day 15	-	15.0	-	-
Day 20	-	15.0	-	-

After two days, samples were tested and vitamin C content in sample A was 11.0mg, sample B (15.0mg), sample D (12.5mg) while sample C had none because it has totally spoilt. Another test was conducted every 5 days on Sample B until the 20th day; the vitamin C content of the samples kept in the refrigerator remained at 15.0mg.

DISCUSSION

Processed tomato paste can last for eighteen months from the date of manufacturing (Aldrich, 2010). In this study, one of the limitations was power failure especially on Sample B. The rate of spoilage of the locally produced paste preserved at different conditions was rapid (Samples A and C); this could be as a result of fluctuation in the ambient temperature, which was not controlled. While Sample B lasted for about 20 days before spoilage was initiated as a result of power failure. A study conducted by Nwanekezi and Onyeali (2005) showed the bacterial count after 40 weeks of storage of tomato paste preserved without oil having bacterial load of 0.35x104cfu/ml and that with oil has a bacterial load of 0.08x104cfu/ml. Bacillus coagulans and Lactobacillus spp were the pre-dominant micro-organism found in the two samples, while Staphylococcus aureus was present only in the sample without oil.

The most significant nutrient in tomato as a fruit is vitamin C, which contains 38.1mg (NFI, 2009). Vitamin C is best known as an antioxidant. When tomato is processed under heat for several hours into puree, the ascorbic acid content reduces, which is indicated in the vitamin C content of standardized tomato puree of between 17.8 – 22.8mg (NFI, 2009). In this study, vitamin C content of locally produced tomato paste on the first day of production before any seemingly preservatives were added was 16.4mg.

The decrease in the ascorbic acid of sample A (11.0mg) and sample D (12.5mg) is in conformity with the research of Nwanekezi and Onyeali (2003) and Sobowale et al. (2012), which observed that there was a decrease in the ascorbic content of tomato paste heat treated and stored using chemical preservatives. Likewise the reduction in those stored under ambient and refrigerated condition is in agreement with the submission of Amer Mumtaz (2010) on characteristics of paste at different conditions.

In conclusion, the tomato paste produced locally was meant to be a panacea to post harvest loses recorded by tomato farmers. From this study, electricity is still a main issue in preservation of tomato paste. Other methods of preservation could be further explored in order to identify the best suitable method. At home level, tomato paste production could be a home remedy for tomato wastage.

REFERENCES

Aldrich HT, Salandanan K, Kendall P et al. (2010). Cultivar choice provides options for local production of organic and conventionally produced tomatoes with higher quality and antioxidant content. J Sci Food Agric. 90 (15): 2548-55..

Amer Mumtaz (2010) Development and quality characteristics studies of tomato paste at different condition. Pakistan Journal of Nutrition 9 (3): 265-268.

Andrea Cespedes (2011). Production of tomato paste. www.livestrong.com.

Anthon GE, Le Strange M, and Barrett DM (2011). Changes in pH, acids, sugars and other quality parameters during extended vine holding of ripe processing tomatoes. J Sci Food Agric. 91(7):1175-81.

Borguini R.G. and Torres E.A. (2009). Tomatoes and Tomato Products as Dietary Sources of Antioxidants. Food Reviews International 25 (4): 313-325.

Ithaca N.Y. (2002). Cooking tomato boost disease-fighting power. Journal of Agricultural and Food Chemistry; 56 (16). 7100-7105.

Jorhat (2005). Post-harvest losses of tomato. Directorate of research, Assam Agric. University http://assamagribusiness.nic.in/2ndoct/post%20harvest%20for%20horticultural.pdf. Accessed 13/6/2012

National Food Institute (2009). Danish Food Composition Databank. www.foodcomp.dk/v7/fcdb_detail.asp. Accessed 18/11/12.

Nwanekezi, E.C. and Onyeali N.O. (2005). Effect of chemical preservation on the shelf life of bottled intermediate moisture tomato paste stored at ambient temperature. Nigerian Food Journal Volume 23, pages 183-192.

Palozza P., Parrone N., Catalano A., Rossella E. Simone, Marco Russo, Giovanni Monego, Kati Froehlich and Volker Boehm (2010). Tomato lycopene and inflammatory cascade: basic interactions and clinical implications. Curr Med Chem.; 17 (23):2547-63. 2010.

Reboul E., Borel P., Mikail C., Abou L., Charbonnier M., Caris-Veyrat C., Goupy P., Portugal H., Lairon D. and Amiot M.J. (2005). Enrichment of Tomato Paste with 6% Tomato Peel Increases Lycopene and {beta}-Carotene Bioavailability in Men. J Nutr. 135 (4):790-4.

Sobowale, S.S., Olatidoye, O.O., Odunmbaku, L.A., and Raji, O.H. (2012). A comparative study on physiochemical and rheological properties of imported tomato pastes in Nigeria. Sustainable Agricultural Research; 1 (2): 51-56.