

Research Paper

Investigating the Use of Alcohol for the Preservation of Fresh Tomatoes

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Abstract: *Ripe healthy tomatoes were placed into 500ml of 0.094M (9.4%v/v), 0.28M (28%v/v), 0.37M (37%v/v) and 0.47M (47%v/v) dilutions of akpeteshie (local alcoholic drink) for a period 14 days. The tomatoes were observed for microbial growth, changes in the shape, texture of epidermis and colour. After 14 days, the tomatoes were used in preparing four different egg-sauces and fifteen volunteers were recruited to take part in sensory and quality analysis on the four egg-sauces. Rankings of: NOT GOOD, OKAY, NORMAL, GOOD and VERY GOOD were assigned to taste, texture and colour of the different sauces in accordance to the preferences of the volunteer tasters and are presented in percentages. The highest ranking for colour was GOOD representing 53.3% of volunteers for tomatoes preserved in 0.37M akpeteshie. Sixty percent (60%) volunteers rated texture of sauce with tomatoes preserved in 0.094M akpeteshie as NOT GOOD and 53.3% volunteers rated taste of tomatoes preserved in 0.094M as NOT GOOD. No microbial growth was observed on tomatoes preserved in the different dilutions. There were however changes in epidermal texture of tomatoes on different days in different dilutions during the period. Sauce prepared with tomatoes preserved in 0.37M concentration was better preferred than the other dilutions.*

Keywords: Akpeteshie, Tomatoes, Preservation, Microbial growth.

Introduction

Tomato (*Solanum lycopersicum*) is a berry usually cultivated as a vegetable in most parts of Ghana mostly in small and large commercial quantities due to its high demand. Tomato however is highly perishable surviving only a few days on the shelf probably due to its high moisture content. A number

of preservation methods such as canning, pickling, tomato pasting, drying, roasting etc are currently used for preserving tomatoes. However each of these methods comes with some undesirable side effects.

Tomatoes are rich in potassium, vitamin B, C, and A, and naturally occurring calories (Beecher, 1998), making them an indispensable part of the everyday diet and a necessary part of at least one meal a day (Engelhard et al 2006). About 45-50% of daily healthy amount of vitamin C can be found in one single tomato fruit. Lycopene in tomatoes are well known antioxidants (Cox, 2001).

Tomato is a seasonal crop and as such may not be available throughout the year. This results in price fluctuations of the produce. Also, the needed factories for large scale processing of tomatoes especially in tomato producing areas are not available leading to high post-harvest losses (Bani et al 2006). It is very disheartening for tomato farmers with no options than to watch their produce go waste any time there is no ready market diminishing the fortunes of tomato farmers (FAO, 1989 and 2006).

Food preservation usually involves preventing the growth of bacteria, fungi and other microorganisms. Alcohol preservation is an ancient and effective way of preserving fruits such as peaches and plums. Alcohol is also used to preserve specimen, especially in industries.

Akpeteshie is a locally produced alcoholic spirit in most parts of Ghana from distilling palm wine or sugarcane juice. The end product of this distillation process contain between 40% to 50% alcohol by volume (Zakpaa et al 2010). Akpeteshie is a volatile liquid and evaporates upon heating. This project is aimed at determining if akpeteshie can be used to preserve tomato fruits. The objectives include determining the concentration of akpeteshie that is suitable for the preservation of tomatoes and to determine the shelf life of tomatoes preserved in akpeteshie.

Materials and Methods

Sample Selection: Fresh ripe and healthy tomatoes (firm texture without any visible signs of disease/mold) were purchased transported to the laboratory. Sixty four pieces of the tomatoes (approximately same sizes) were selected and washed with tap water. One gallon of akpeteshie (local alcoholic drink) was also purchased from a distillation point.

Preparation of Different /Molar Concentrations of Akpeteshie: Molar Concentrations of 0.094M, 0.28M, 0.37M and 0.47M of the alcohol were prepared. 500ml of each molar concentration were poured into four 1.5liters capacity containers and labeled. 500ml of 0.01M (NaCL) was put into a fifth 1.5liter container and labeled as control.

Treatment of Fresh Tomatoes with Different Dilutions of Akpeteshie: Sixty four (64) pieces of fresh ripe tomatoes were divided into four parts and weighed (approximately 160g). Each part (160g) was further divided into four parts and placed into the labeled 1.5liter capacity containers corresponding to each dilution of the alcohol. The prepared solutions where then poured into their respective labeled containers containing four pieces of tomatoes, covered and observed for changes in the shape, colour and smoothness of the epidermis (skin) for 14 days.

Preparation of Tomato Egg-Sauce and Taste, Colour and Texture Evaluation: At the end of the 14 days, four egg-sauces were prepared with the differently preserved tomatoes using the same procedure as well as other necessary ingredients. Fifteen (15) volunteers were then recruited for quality and sensory analysis. The different egg-sauces were labeled with identification codes and presented to the volunteers (one at a time) on the same day of preparation. Ratings assigned to the different egg-sauces were tallied and presented in percentages. Nil refers to no ranking assigned.

Results and Discussion

Changes Observed in Tomatoes during Preservation in Akpeteshie: During the first 11 days in control solution, the shapes, colour and skin of tomatoes were completely altered and microbes were seen growing on them. The shape and colour of tomatoes preserved in the different alcohol concentrations remained the same and no microbial growth was observed. The skin of tomatoes preserved in 0.094M was slightly altered and there was change in colour of 0.47M solution from colourless to slight red, even though the shape of the tomatoes remained the same and no microbial growth was observed.

On the 12th day, the shape of tomatoes in 0.094M remained the same. However the shape of tomatoes in the 0.28M solution, were slightly altered but no microbial growth was observed. Color of the tomatoes also remained the same. On day 14, tomatoes in 0.37M were still free from microbial growth. The colour and shape of the tomato was also not altered.

Rating of Egg-Sauce Produced With the Preserved Tomatoes:

Table 1: Rating of egg-sauce produced with preserved tomatoes

Sensory test	Preference Rating(range)	Concentration			
		0.094 M	0.28 M	0.37 M	0.47 M
Colour	1	nill	nill	nill	nill
	2	nill	nill	nill	nill
	3	20%	20%	nill	40%
	4	46.7%	40%	53.3%	40%
	5	33.3%	40%	40%	20%
Texture	1	60%	13.3%	nill	nill
	2	33.3%	40%	13.3%	13.3%
	3	20%	20%	26.7%	26.7%
	4	nill	13.3%	40%	26.7%
	5	nill	nill	20%	33.3%
Taste	1	53.3%	13.3%	nill	nill
	2	40%	40%	13.3%	6.7%
	3	20%	20%	13.3%	26.7%
	4	nill	26.7%	33.3%	26.7%
	5	nill	nill	40%	40%

Range: 1→ NOT GOOD 2→ OKAY 3→ NORMAL 4→GOOD 5→VERY GOOD

Colour Rating: A number of volunteers rated colour of sauces produced with the tomatoes as GOOD. These include, Seven (7) volunteers representing 46.7% from 0.094M concentration, six (6) volunteers representing 40% from 0.28M concentration and 0.47M concentration and finally eight (8) volunteers representing 53.3% of 0.37M concentration (Table 1).

Texture Rating: For 0.094M concentration, nine (9) volunteers representing 60% rated texture as NOT GOOD. 40% (six volunteers) rated texture of tomatoes from 0.28M as OKAY. Also, six (6) volunteers (40%) rated texture of tomatoes from 0.37M concentration as GOOD (4). In concentration of 0.47M alcohol, five (5) volunteers (33.3%) rated texture as VERY GOOD.

Taste: In concentration of 0.094M, 53.3% (eight volunteers) rated taste as NOT GOOD. Six (6) volunteers (40%) considered taste of sauce from 0.28M OKAY and sauce from 0.37M as VERY GOOD and also in concentration of 0.47M alcohol as VERY GOOD (Table 1).

Tomatoes preserved in the control solution were completely rotten by eleven days and microbes (fungi) were observed growing on them even after day 3 of preservation. No microbial growths were observed in all the samples preserved in the different concentrations of the akpeteshie. Ethanol disinfects by denaturing proteins and dissolving lipids. Akpeteshie like other alcoholic beverages has high amount of ethanol. This could account for the inhibitory effects observed. During the first eleven days, change in colour of the 0.47M solution could be due to loss of water from the tomatoes into the solution by osmosis. Changes in the skin of tomatoes in the 0.094M solution imply the tomatoes could only be preserved for a maximum of ten (10) days in that solution. By the 12th day, changes were observed in the skin of the tomatoes preserved in 0.28M alcohol solution though no growth of microbes was observed. This also implies the tomatoes could only survive for eleven days in that concentration. The survivals of the tomatoes in the 0.37M concentration imply the solution was right for preservation for a 14 day period. This was reflected in the preference ratings conducted where the highest GOOD rating of 53.3% was for colour, 40% for texture and 40% for taste.

The highest ranking of NOT GOOD for texture was 60% for tomatoes in 0.094M solution (Table 1). This could be due to the observation on the 11th day of preservation whereby the texture of epidermis of the tomatoes was altered. Tomatoes in 0.094M solution also received a 53.3% NOT GOOD rating for taste as well.

Conclusion and Recommendations

Short term preservation of tomato with 0.37M akpeteshie is possible. Further research regarding proximate analysis is required to determine nutritional value of tomatoes preserved in akpeteshie.

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