The effect of Garlic treatment on Concentrating Temperature, Potassium Sorbate, Proximate Composition and Sensory properties of Tomato Paste.

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ABSTRACT: Campbell 37 variety of fresh tomato was investigated. These were concentrated at different temperatures of 50OC and 70OC to produce tomato paste. During the concentration to produce paste, garlic at 0.1%w/w, 0.2%w/w and 0.3%w/w concentration and 0.02 and 0.05 potassium sorbate were added. After the production of the tomato paste (treated and the control samples) the proximate analysis was determined. The moisture content of the samples concentrated at 50OC was significantly higher than those of the samples concentrated at 70OC thus, having a moisture content range of 78.19% - 78.67% when compared to the 70OC which is 76.13% - 76.74%. Protein content of the 70OC (11.14-11-20%) concentrated temperature is significantly higher than the protein content of the 50OC (10.67-10.79%) concentrated samples. The ash content of the sample at 50OC treated with 0.1%w/w KS and 0. 2%w/w KS has no significant difference at (P < 0.05). The same trend was observed on the sample at 70OC which are 9.14% and 9.17%. The sensory properties of the samples were evaluated using trained panelist at 9 points hedonic scale. The sample concentrated at 700C, has a low score in the appearance. Potassuim sorbate at both concentration of 0.2 and 0.5 did not affect the aroma and flavour of the sample. Garlic affected the aroma and hence the low score at 700C concentration.

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INTRODUCTION

Tomato is the most widely consumed vegetable and being the second most important vegetable crop worldwide. It is strongly associated with a reduced risk of chronic degenerative disease. The lycopene is the main antioxidant that fights against degenerative disease and is heat sensitive and can be easily destroyed by heat (1). Giovannucci *et al* {1}(2002)

Tomatoes are widely grown and used in Eastern African. During the peak season, most farmers sell their tomatoes at give-away prices, and substantial quantities are wasted because they are highly perishable [2]CTA (2007). Fresh and ripe tomato cannot be kept for so long in the store yard at ambient temperature for 24-48 hrs as this will cause inferior finished product[3]. (Anonymous, 2001). To avoid spoilage, farmers can process tomato into various products for storage and uses at home or as value added product for income generation.

There are different methods of processing tomato. Traditionally, the method of processing tomato is by concentrating tomato into paste, puree and drying. There are other methods of tomato processing which are sundried tomato, tomato sauce, tomato juice, tomato ketchup, tomato powder etc. All manufacturers of tomato paste have similar processes of manufacturing it. However, each is unique in the type of equipment utilized and the manner in which the equipment is combined to form a process [4]. (Hattes, 2009).

Generally speaking, the lower the operating temperature ,the better the flavour and colour of the finished product. To make a thicker paste, the concentration is left for a longer time in the evaporator. Unfortunately, the more heating a product undergoes, the more flavour loss and distortion that occurs. So paste has greater flavour loss and distortion than puree. Heat is the single biggest factor affecting tomato flavor. Heat affects tomato products in two ways. First, it decreases fresh flavour compound. Second, it increases cooked flavour compound. Fresh tomato flavour is derived from volatile compound specifically, C-3-hexenal and Z-3 hexenal. Heat increases their volatility. During heating, these compounds escape into the atmosphere, creating the wonderful tomato aroma. Unfortunately, this also results in a corresponding flavour loss in the sauce. Both heating time and temperature affect flavour loss [5]. (Corell, 2000). Heating must be done with care. Continuous heating turns sauce colour from bright red to brownish red which is why colour is used as a key indicator of quality.

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SCOPE OF WORK

This research work used different preservatives such as potassium sorbate at different concentrations (0.1%w/w and 0.2%w/w) and 3%w/w garlic. After steaming the paste at temperature of 50^{O}C and 70^{O}C, the effect of the parameter on proximate composition and sensory properties of the product were determined.

OBJECTIVE OF THE STUDY.

Broad objective

The broad objective of this study was to assess the effect of preservative and concentrating temperature on the proximate composition and sensory properties of tomato paste.

Specific Objectives

- To determine the sensory properties of tomato paste concentrated at different temperature.
- Effect of Potassuim sorbate treatment on the proximate composition of tomato paste
- To determine the effect of garlic addition on the proximate composition and sensory properties of tomato paste
- To determine the effect of different concentrating temperature on the proximate and sensory properties of tomato paste.

MATERIALS AND METHOD

SOURCE OF MATERIAL

Tomato fruits were sourced from Umuahia Central Market, Abia State, Nigeria and the botanical identity was authenticated at the Department of Agronomy of Michael Okpara University of Agriculture, Umudike (MOUAU) using the colour, shape and texture of the fruit. Laboratory and other facilities used for the project work were obtained from Department of Food Science and Technology Laboratory of Michael Okpara University of Agriculture, Umudike Abia State, Nigeria.

PASTE PRODUCTION.

The method recommended by the EEC codex and reported by Pearson, [6]. (1976), was employed in the production processes. The fresh hard ripped tomato fruits were washed properly in tap water and examined closely for disease symptoms and for infections. Only whole ones were used. The sorted fruits were weighed out in 2 kg portions. This was then rinsed in portion of distilled water prior to use. The fruits in each case were blanched in water at 80^{O}C for 30 min. The blanched fruits were peeled and then ground using laboratory

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blender (Q - Link, model no.QBL-20L330 manufactured in Shang Hai, China) and sieved (1mm) to recover the seed which were not part of the required portion of the production of tomato paste.

The ground tomato mass was then heated on a laboratory hot plate (which has an inbuilt thermostat) with string facility (Clifton, USA), until the mass thickened into a paste. Concentrating in each case was done at specified temperature of 50^{O}C and 70^{O}C. All the paste products were arranged accordingly to their temperature treatment and then the designated preservatives treatments (potassium sorbate and garlic) were added as follows: Potassium sorbate was added at two different concentrations of 0.1%w/w and 0.2%w/w and 3%w/w garlic.

This was later used for proximate analysis and sensory properties determination.

ANALYSIS

3.2.1 Determination of Protein

Determination of protein was carried out using Kjeldahl method as described by Chang, [7]. The total N_2 was determined, which was then multiplied with a factor 6.25 to obtain the protein content.

Procedure

The sample (5.0g) was mixed with 10 ml of conc. H_2SO_4 in a digestion flask. A tablet of Selenium catalyst was added and this was then heated under a fume cupboard unit. A clear solution was obtained which is the (the digest). The digest was then made up to 100 ml with distilled water in a volumetric flask.

From the digest, 10 ml was mixed with 45% Na0H solution in a Kjeldahl distillation apparatus. The mixture was then distilled into 10 ml 4% boric acid which contained 3 drops of mixed indicator (bromocressol green methyl red). The distillate was then collected and titrated against 0.02N EDTA from green to deep red end point. A reagent blank was also digested, distilled and titrated against with 0.02N EDTA. N_2 content was calculated and the protein content calculated as:

$$\%\ \text{protein} = \%N_2 \times 6.25$$

$$\%\ N_2 = \frac{[100 \times W \times N \times 14 \times VT] \quad \times (T-B)}{W \quad \times \quad 1000 \times \quad Va}$$

Where

W = Weight of sample (0.5g)

N = Normality of titrate (0.02N H_2SO_4)

VT = Total digest volume (100 ml)

Va = Volume of digest analyzed (10 ml)

T = Sample titer value.

B = Blank titer value

3.2.2 Determination of Moisture Content

This was done by gravimetric method as described by AOAC, [8]. (1990). The sample (5.0g) was weighed into pre-weighed moisture Can. The sample was dried in an oven at $105^{O}C$ for 3 h. It was then transferred to a desiccator for the Can to cool and then weighed. The Can was then returned to the oven for further drying. Drying, cooling and weighing were done constantly at one hour interval until a constant weight was obtained. Weight of moisture loss was calculated and expressed as a percentage of the weight of sample analyzed. It was given by the expression below:

$$\% \text{ moisture content} = \frac{100}{1} \times \frac{W_2 - W_3}{W_2 - W_1}$$

W_1 = Weight of empty msoisture Can

W_2 = Weight of empty Can + Sample before drying

W_3 = Weight of Can + sample dried to const. weight.

3.2.3 Determination of Ash

The method as described by James, [9]. (1995) was used. This involves the use of furnace incineration gravimetric method. The sample (5.0g) was weighed out and was dispensed into a pre-weighed empty crucible. The weighed sample was then burnt into ashes in muffle furnace at $500^{O}C$ for 3 h. After ashing, the crucible was transferred into desiccator for it to cool and re-weighed. The weight of ash obtained was calculated by difference of the weight and expressed as a percentage of the weight of sample analyzed as expressed by the formula below:

$$\% \text{ Ash} = \frac{100}{1} \times \frac{W_2 - W_1}{\text{wt. of sample}}$$

Where W_1 = Weight of empty Crucible

W_2 = Weight of Crucible + Ash

3.2.4 Determination of Fat

The solvent extraction as described by Kirk and Sawyer, [10]. (1989) was employed. The sample (5.0g) was wrapped in a porous paper (white man filter paper). This was then put in a thimble. The thimble was inserted in a Soxhlet reflux flask which was mounted in a weighed extraction flask that contained 200 ml of petroleum ether. To the upper end of the reflux flask was connected a water condenser. When the petroleum ether was heated, boiled, vaporized and condensed, the thimble was then covered with the

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solvent. Then the oil in the sample was extracted into the boiling flask. The experiment was allowed to run for 4 h until there was no oil left to be extracted. Then the defatted sample was removed. The solvent was recovered and the extracted oil was left in the flask. The oil was dried in the oven at $60^{O}C$ for 30 min. This was done to remove any residue solvent. The flask was cooled in a desiccator and weighed. The weight of oil extracted was determined and expressed as a percentage of the weight of sample analyzed and given by the formula below:

$$\% \text{ Fat} = \frac{W_2 - W_1}{\text{Wt. of sample}} \times \frac{100}{1}$$

Where W_1 = Weight of empty extraction flask

W_2 = Weight of Flask + Oil extracted

3.2.5 Determination of Crude Fiber

The Weende method as described by James, [11]. (1995) was used. The sample (5.0g) was boiled in 150 ml of 1.25 H_2SO_4 solutions for 30 mins under reflux. The boiled sample was then washed in several portions of hot water using a two-fold muslin cloth and allowed to drain before being transferred to a pre-weighed crucible where it was dried in the oven at $105^{O}C$ to a constant weight. This was taken to a muffle furnace where it was burnt to ash. The weight of the ash was obtained by difference and expressed as a percentage of the weight of sample analyzed as expressed by the formula below:

$$\% \text{ Crude Fiber} = \frac{100\,(W_2 - W_3)}{\text{Wt. of Sample.}}$$

Where W_2 = Weight of Crucible + Sample
After boiling, washing and drying.

W_3 = Weight of Crucible + Sample as ash.

3.2.6 Determination of Carbohydrate

The available carbohydrate in the sample was calculated by

% carbohydrate = 100 – % (protein + fat + fiber + ash + moisture content).

SENSORY EVALUATION

Sensory evaluation of tomato paste was carried out for appearance, taste, aroma and general acceptability by a Panel of 10 semi trained Judges which comprised the Postgraduate Students of the Department of Food Science and Technology. Samples were presented in succession and panelists were asked to rate the quality attributes according to 9-points Hedonic scale ranging from liked extremely well (9), liked very well (8), liked moderately (7), liked slightly (6), neither liked nor disliked (5), to dislike extremely (1), as described by Larmond, [12] (1977) and Iwe, [13]. (2002).

RESULT AND DISCUSSION

Table 4.10 depicts the proximate composition of tomato paste concentrated at 50^{O}C and 70^{O}C treated with different concentrations of potassium sorbate and 3%w/w garlic kept at ambient temperature. From the table, the moisture content of the samples concentrated at 50^{O}C was significantly higher than those of the samples concentrated at 70^{O}C thus, having a moisture content range of 78.19% - 78.67% when compared to the 70^{O}C which is 76.13% - 76.74%. This could be attributed to the different concentrating temperature given to the samples.

The moisture content of sample treated with 0.1%w/wKS and 0.2%w/wKS are significantly difference. Moisture content of some materials with definite air humidity can change depending on differences between water activity in the material and humidity of the surrounding air, [14]. (Blahovec, 2007). The moisture content of the samples was affected because of the differences in heat treatment given to the samples.

Protein content of the 70^{O}C (11.14-11-20%) concentrated temperature is significantly higher than the protein content of the 50^{O}C (10.67-10.79%) concentrated samples. The result showed that tomato paste is not a good source of protein, when compared with other food like curd from milk which has 40-42%/100 g and other protein containing food. The higher temperature must have contributed to the reduction of the moisture content. Food concentrated at a higher temperature will result in a higher moisture loss, and have more solid per unit weight. In this regard 1g of the higher temperature sample contains much more of the sample (solid unit) than its lower temperature counterpart. This resulted in higher content of nutrient. This is so because the nutrient is reflected in the solid form and not in the moisture. Tomato plant contains a little protein and is not consumed for their protein intake. This is the major reason in variation in the nutrient content of 50^{O}C and 70^{O}C heated pastes.

The ash content of the sample at 50^{O}C treated with 0.1%w/w KS and 2%w/w KS has no significant difference at ($P < 0.05$). The same trend was observed on the sample at 70^{O}C which are 9.14% and 9.17%. The sample with potassium sorbate has the highest ash content. This is a reflection of the potassium sorbate added. Addition of chemical preservatives like potassium sorbate increases the ash content of a sample and will decrease if store for a long time (Saeed *et al.*,[15]. 2010). The fiber content of the result obtained is not in line with the fiber of tomato paste which is 2.5/100 g. This could be supported by Daneke and Cane, [16]. (2006), that tomato by-product are highly significant, their physical form, chemical composition and subsequent nutritional value depend on the relative proportion of peel, seed and other remaining material left by various steps of process. Tomato skin and peel has a low protein and fat content and a high crude fiber (Knoblich *et al.*,[17] 2003; Mesbaihie *et al.*, [18]. 2009). Since the skin and the peel were not part of the tomato production this could

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speak for the low crude fiber content. The crude fiber of the 70^{O}C concentrated tomato pastes were lower than the pastes steamed at 50^{O}C this could be supported by Granfeidt *et al.*, *[*19*]*. (1995) that processes involving high treatment may affect fiber in different ways in that an increase in temperature leads to breakage of weak bond between polysaccharides chains. This will result to decrease in the content of the fiber. Also tomato is not a good source of fiber. Vegetable with high moisture content are known to have low crude fiber (Okafor, [20]. 1996; Udosen, [21]. 2010).

Table1: Proximate composition of ambient kept Tomato Paste concentrated at 50^{O}C and 70^{O}C with different concentrations of potassium sorbate and 3% w/w garlic.

Paste	Proximate Composition (g/100g)					
Concentrated at 70^{O}C						
	Moisture	fat	ash	crude fiber	protein	CHO
Control	76.74^{c}	1.20^{c}	8.66^{c}	1.69^{b}	11.14^{ab}	0.64^{a}
0.1% w/wks	76.35^{de}	1.25^{ab}	9.14^{a}	1.69^{b}	11.14^{ab}	0.43^{a}
0.2% w/wks	76.13^{e}	1.23^{bc}	9.17^{a}	1.67^{b}	11.20^{a}	0.46^{ab}
3% w/w garlic	76.48^{cd}	1.27^{a}	8.84^{b}	1.85^{a}	11.20^{a}	0.65^{ab}
Paste Concentrated at 50^{O}C						
Control	78.67^{a}	0.91^{e}	7.79^{f}	1.27^{d}	10.73^{bc}	0.77^{a}
0.1% w/wks	78.46^{a}	0.93^{de}	8.44^{e}	1.04^{e}	10.67^{c}	0.67^{ab}
0.2% w/wks	78.2^{b}	0.93^{de}	8.48^{de}	1.05^{e}	10.73^{bc}	0.46^{ab}
3% w/w garlic	78.19^{b}	0.95^{d}	8.54^{d}	1.47^{c}	10.79^{bc}	0.36^{b}
Mean	77.40	1.084	8.63	1.47	10.95	0.56
LSD	0.324	0.034	0.07	0.04	0.44	0.35

Means with the same letter down the column are not significantly different at ($p<0.05$)

KS=Potassium Sorbate.

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Table 2 depicts the sensory parameter of tomato paste concentrated at 50^{O}C and 70^{O}C with different concentrations of potassium sorbate and 3%w/w garlic which was kept at ambient temperature. In the 50^{O}C concentrated samples there is no significant different in the appearance of the control sample, potassium sorbate treated samples and the garlic containing sample. The same trend was also observed in the 70^{O}C concentrated samples however, the appearance of the garlic treated sample is significantly different at ($p<0.05$). This could be attributed to the raw garlic which contains amino acid. When garlic is crushed the amino acid forms pyrole compound which colour tends towards slightly blue (Sally, [22]. 2012).This contributed in masking of the appearance of the garlic treated paste and hence the low score. Concentrating of the product at 70^{O}C may have contributing to the low score, as operating temperature affect appearance of product (Boumendjel *et al*., [23]. 2011). Similar work was reported by Rodrigo *et al*., [24]. (2007) and Sahlin *et al*., [25]. (2004) that appearance is always affected by heat treatment temperature and its variation does not affect the commercial quality product.

It was observed that the taste of the garlic containing samples concentrated at 70^{O}C had a low score. The aroma and taste of the potassium sorbate tomato paste are not significantly different in both at 50^{O}C and the 70^{O}C concentrated tomato paste. Potassium sorbate does not affect the taste, colour and aroma of product Clark, [26]. 2010). Also the result indicated that there was no significant difference in the general acceptability of the control sample, garlic and potassium sorbate treated sample at 0.1% concentration. However, potassium sorbate treated at 0.2% was more accepted than the other samples

Table 4.2: Sensory Quality of ambient kept Tomato Paste concentrated at $50^{O}C$ and $70^{O}C$ with Different concentrations of potassium sorbate and 3%garlic.

Paste concentrated at $70^{O}C$	Appearance	Taste	Aroma	G/A
Control	7.20^{g}	7.20^{a}	6.80^{cd}	7.60^{b}
0.1% w/wks	7.50^{d}	7.10^{ab}	7.10^{bc}	7.60^{b}
0.2% w/wks	7.30^{f}	7.40^{a}	7.30^{ac}	8.0^{ab}
3% w/w garlic	6.30^{h}	6.60^{b}	6.40^{d}	7.70^{b}
Paste concentrated at $50^{O}C$				
Control	7.80^{a}	7.30^{a}	7.70^{a}	8.50^{a}
o.1% w/wks	7.70^{b}	7.30^{a}	7.40^{ab}	8.40^{a}
0.2% w/wks	7.60^{c}	7.40^{a}	7.60^{a}	8.30^{a}
3% w/w garlic	7.40^{e}	6.90^{ab}	7.10^{a}	8.00^{ab}
Mean	7.35	7.15	7.18	8.01
LSD	0.062	0.583	0.502	0.535

Means with the same letter down the column are not significantly different at ($p<0.05$)

KS=Potassium Sorbate ,G/A= General Acceptability.

CONLUSION

The results obtained from this study showed that tomato paste concentrated at 70^0C has higher protein content than 50^OCconcentrated sample. Concentrating temperature plays a major role in moisture content and protein content. Also the potassium sorbate treated samples were highly accepted at 2%. This indicated that potassium sorbate has no effect on the nutritional composition and quality attributes of the paste

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