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Full Length Research Paper

Effects of Different Pretreatments on the Nutritional and Sensory Qualities of Tomato (*Lycopersicum esculantum)* Powder

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Abstract

Tomato (Lycopersicum esculanta) is highly perishable and postharvest losses are very high in Nigeria. This work was aimed at producing acceptable tomato powder using different pretreatment methods. The treatments included deseeding , treatment with lime and/or Sodium metabisulphite solutions. The samples were ground, dried and milled to powder. The samples containing seeds had significantly higher values for moisture, protein, ash, fat and crude fibre. The ascorbic acid, lycopene and β-carotene values as well as the taste and colour acceptability scores were significantly highest ($p \leq 0.05$) among the samples treated with lime and sodium matabisuphite solutions. The control samples (dried without pretreatment) had significantly lower ($p \leq 0.05$) values for each of these parameters.

Key Words: *Pretreatments, Nutritional, Sensory, Tomato*

Introduction

Tomato fruits *(Lycopersicum esculantum)* occupy a crucial position as an ingredient in most recipes in Nigeria. It is consumed raw in salads and in drinks or cooked in sauces and stews. While tomato is a botanical fruit, it is considered a vegetable for culinary purposes (Macrae et al, 1993). Tomato can be processed into a variety of products such as tomato paste, purees, ketchup, etc.

The nutritional composition of raw tomato as reported by Li and Hu (2000), showed Calcium(11mg), Iron(0.6mg), Vitamin A(700IU),Thiamine(0.06mg), Ascorbic acid 923mg, riboflavin(0.04mg) and niacin(0,5mg) per 100g sample respectively. Tomato contains lycopene, one of the most powerful natural antioxidants, which especially when cooked, have been found to prevent prostrate cancer.(Smith, et al, 1987). The tomato skin contains five times more lycopene (540mg/kg) than the tomato pulp (110mg/kg). The lycopene was more in the insoluble portion of the fruit than in the soluble portion. (Shi and Le Maguer, 2000).

Tomato is highly perishable. Annual losses in tomato is as high as 60% (Peterson and John, 1974), which leads to short supply and high price of tomato and tomato products. Therefore tomato must be processed into different forms in order to improve its shelf life. This can be done through canning, bottling, refrigeration, freezing, drying, etc. (Arthrey and Dennis, 1991). In Nigeria and in most developing countries, canning industries are very few and home canning facilities are lacking. Also, refrigeration and freezing are not feasible because of high cost as well as poor/ inefficient electric supply. The only cheap option left is to sundry the tomatoes during the dry season.

Currently, sundried tomato slices are available in the market during off seasons. But consumers of such products experience a lot of difficulty in grinding it. Besides the product is usually contaminated with sand grains due to unhygienic processing conditions. These factors discourage its usage among tomato consumers. Therefore it has become necessary to develop an indigenous technology for processing of tomato. The aim of this work therefore is to produce acceptable tomato powder using different pretreatment methods.

Methodology

Ripe but firm tomato fruits were obtained from Relief market Owerri, Nigeria. The fruits were washed and blanched by dipping into boiling water for one minute and immediately cooled under running water. The blanched fruits were halved and divided into two equal portions. One part had their seeds removed, while the other still contained the seeds. Each of the two portions was sub-divided into four parts. One part was treated with lemon juice (diluted 1:1 with water for ten minutes), another part was treated with sodium metabisulphite (21g/1000ml for 10 minutes), the third part was treated with both. The last batch, the control, was not given any pretreatment.

The tomato samples were drained and ground to pulp. The pulp was boiled to evaporate moisture to half the original volume. The concentrate was dried in an oven at 60^{o}C to a moisture content of ≤5. The dried tomato flakes were allowed to cool to room temperature and then ground to fine powder. They were packaged in glass bottles prior to subsequent analysis.

The proximate composition of the sample was determined using methods described by AOAC (1990). The ascorbic acid, lycopene and β-carotene were determined using the methods described by Osborne and Voogt (1978), fish et al 2002) and AOAC(1990) respectively. The sensory evaluation was carried out on the products using a 9-point hedonic scale for colour and taste. The results obtained were subjected to statistical analysis using analysis of variance(ANOVA) and means were separated using the least significant different (LSD) to determine which samples were significantly different at p≤0.05 (Ihekoronye and Ngoddy,1985)

Results and Discussion

The results are shown on Table 1. The dried samples were significantly different (p≤0.05) from the fresh sample in all the parameters analyzed. This is due to the very high moisture content (96.26%) of the fresh tomato. The tomato samples dried with the seeds (SST, LST, SLS and CST) had significantly higher (p≤0.05) values for moisture (4.23%-4.40%) than those dried without the seeds (SDT, LDT, SLD and CDT) which ranged from 2.47% to 2.97%. The presence of the seed proteins might have increased the water holding capacity of the samples thereby making loss of moisture, below this point very difficult (Ihekoronye and Ngoddy, 1985). The ash, fat, protein and crude fibre content of the seeded samples were also significantly higher (p≤0.05) than the values found among the deseeded samples. The carbohydrate content was lower among the seeded samples. However no significant difference was observed in the proximate composition of the samples within each group (seeded and deseeded).

Table 1. Nutritional composition and sensory scores of dried tomato samples

tomato samples	Moisture %	Ash%	Fat%	Protein %	CrudeFibre %	Carbohydrae %	Vitamin C mg/100g	Lycopene mg/100g	B-carotene Mg/100g	colour	taste
Fresh	96.26^{a}	0.43^{c}	0.25^{c}	1.87^{a}	0.76^{c}	0.43^{b}	18.68a	357^{a}	29.00a	9.00^{a}	9.00^{a}
SST	4.40^{b}	6.23^{b}	2.40^{a}	o.82^{b}	6.50^{a}	79.65a	14.37	314^{b}	24.77^{c}	6.60^{b}	6.80b
LST	4.23^{b}	6.67^{b}	2.36^{a}	0.89^{b}	6.83^{a}	79.02^{a}	16.63^{c}	319^{b}	24.83^{c}	6.70^{b}	6.90^{b}
SLS	4.27^{b}	6.77^{b}	2.83^{a}	0.84^{b}	6.70^{a}	79.16^{a}	16.23^{b}	310^{bc}	24.33^{c}	7.20^{b}	7.40^{ab}
CST	4.24^{b}	6.50^{b}	2.87^{a}	0.83^{b}	6.73^{a}	78.83^{a}	5.30^{b}	124^{d}	27.62^{b}	6.35 b	5.90^{bc}
SD	2.83^{c}	7.27^{a}	1.43^{b}	0.51c	5.20^{b}	80.37^{a}	12.80^{d}	299^{c}	19.69^{e}	7.40^{b}	6.70^{b}
LDT	2.97^{c}	7.13^{a}	1.60^{b}	0.60^{b}	5.20^{b}	80.66^{a}	12.70^{d}	301^{c}	18.23^{f}	6.80^{b}	8.40^{a}
SLD	2.80^{c}	7.23^{a}	1.63^{b}	0.67^{c}	5.40^{b}	80.24^{a}	14.13^{c}	298c	16.17^{f}	7.50^{b}	7.50^{ab}
CDT	2.47^{c}	7.56^{a}	1.07^{b}	0.54^{c}	5.50^{b}	80.39^{a}	3.10e	115^{e}	12.13^{g}	6.50^{b}	5.50^{c}

Means with same superscript on the same column are not significantly different (p≥0.05)

Key:

SST-Seeds present, treated with Sodium metabisulphite
LST-Seeds present, treated with lime
SLS-Seeds present, treated with lime and Sodium metabisulphite
CST-Control (with seeds present)
SDT-Deseeded, treated with Sodium metabisulphite
LDT- Deseeded, treated with lime
SLD-Deseeded, treated with lime and Sodium metabisulphite

CDT-Control, (deseeded)

The ascorbic acid content was significantly lowest ($p \leq 0.05$) in the control samles CST and DST with values of 5.30mg/100g and 3.10mg/100g respectively. The samples treated with lime had higher ascorbic acid values. This may be attributed to the high ascorbic acid content of the lime solution used in the pretreatment. The control samples (CST and CDT) had significantly lower ($p \leq 0.05$) values of 124mg/100g and 115mg/100g for lycopene. The values in the treated samples ranged from 298mg/100g for SLD to 319mg/100g for LST. The fresh sample had 357mg/100g lycopene. This suggests that the dried tomato is a reliable source of lycopene which is a major antioxidant in found in plants. B-carotene was highest among the seeded samples with values ranging from 24.33mg/100g to27.62mg/100g. The lowest values were observed in the deseeded control sample (DST).

The colour and taste retention was high for all the samples as shown from the results of the sensory evaluation (Table 1). However, the values were lowest among the control samples. The generally high scores for colour of the pretreated dried tomato agrees with the high lycopene values reported for those samples. The improvement in sensory qualities of dried fruits treated with lime and sodium metabisulphite has also been reported by Weibel, 1999; Kendal and Sofos, 2007.

Conclusion

From the results, it can be seen that drying of the pretreated tomatoes did not have an adverse effect on most of the nutritional and sensory parameters evaluated. Tomato samples dried with the seeds had higher values for moisture, protein and fat. This may result to a shorter shelf life due to rancidity or microbial growth. So removal of the seeds prior to drying is recommended. Treatment with lime and/or sodium metabisulphite produced commendable results. Ascorbic acid, carotene and lycopene, a major micronutrient of interest in tomato, were all better retained in the pretreated samples than in the control. Information such as this will encourage the use of dried tomato. This will reduce the amount of postharvest losses experienced by farmers and tomato sellers. Also, the difficulty in grinding the dried halved tomato has been overcome since the product obtained is in powdered form.

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