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EFFECT OF STORAGE MATERIALS ON THE PROXIMATE COMPOSITION OF TOMATO (Lycopersicon Esculentum) POWDER

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ABSTRACT

The effect of storage materials on the quality of tomato powder was studied. Fresh, firm and matured red tomatoes were washed, sorted and sliced to a uniform thickness of 5mm. The sliced tomatoes were pre-treated by dipping in 1% calcium chloride ($CaCl_2$) and 0.2% potassium metabislphite (KMS) solution for 10 minutes at room temperature. 200g each of the sample was dried at temperatures of 60^0C until equilibrium moisture content was attained. The dried tomatoes were ground into powder and stored in Black polyethylene [BPE], White polyethylene [WPE], and Laminated Aluminium Foil [LAF] pouches for 6 weeks. The moisture content, crude protein, crude fibre, fat, total ash, and vitamin C of the tomato powder were determined using the method prescribed by AOAC. The carotene contents were determined by HPLC. The proximate analysis was repeated after 2 weeks, 4 weeks and 6weeks of storage. There was an increase in moisture content and ash content after 6 weeks of storage while a decrease in value of protein, fat and vitamin C content occurred after the storage period. All the parameters measured were best retained by the laminated aluminium foil (LAF) compared to black polyethylene (BPE) and white polyethylene (WPE) packaging material for the entire period of the study.

Keywords*: Tomato, Tomato powder, Storage, Polyethylene, Vitamin C*

INTRODUCTION

Tomato belongs to the genus lycopersicum of the family Solanaceae (Cox, 2000). It is believed to have originated from Andean region from where it was exported to Europe in the 16th century. Today, tomato is grown all over the world and it is considered to be one of the most important vegetable crop (Bergougnoux, 2014). Chan, 1983 reported that tomato plant is second most important crop in the world in terms of volume and area of production. According to Hossain *et al.,* 2010, tomato is the third largest produced vegetable crop after potato and sweet potato across the world. Tomato has been found to contain a substantial amount of vitamins and other essential nutrients. Bergougnoux, 2014reported that it is an important source of nutrients such as vitamin C, lycopene, and β-carotene, which are all important for good human health.

Studies have shown that tomato can be used to cure several diseases with its use most common in traditional medicines. Tomato's lycopene pigment reduces the risk of cardiovascular disease and other fresh fruits and vegetables are also associated with many health benefits such as reduced incidence of cancers, heart diseases and many chronic diseases of ageing (Alam *et al.*, 2019; Andritsos *et al*., 2003; Gracia *et al*., 2010). These health benefits have been attributed to the presence of bioactive phytochemicals, vitamin C, carotenoids, and the phenolic content of tomatoes (Mordente *et al.*, 2011). The tomato fruit is a major source of lycopene in the human diet (Gracia*et al*., 2010). According to Rath (2009), the lycopene content in tomato may be as high as 70 to 130 mg/kg depending on the variety, geographic location, technique of cultivation, climatic conditions and degree of ripeness of tomato fruits. Frequent consumption of lycopene has been found to reduce the risk of postrate cancer (Stacewicz-Sapuntzakis & Bowen, 2005; Kirsh*et al.*, 2006).

In Nigeria, tomato is regarded as one of the most important vegetable crop (Olaniyi *et al.,* 2010). Post-harvest handling of tomatoes is an important issue because it is highly perishable in its natural form hence; they continue to undergo undesirable changes during handling. According to Olaniyi, 2010, in Nigeria, post harvest losses of tomato may be as high as 20% while at global level losses is estimated to be as high as 30 - 40% (Agrios, 2005).Post-harvest losses in tomatoes cannot be eliminated, but can be reduced if appropriate post harvest technologies are applied. Extending the shelf life of tomato is very important for domestic and export marketing.

To increase the shelf life of tomatoes, different preservation techniques are being employed that comprise of manipulation of storage temperature and relative humidity, addition of chemical preservatives, protection against air/germs pollution through waxing, dehydration and processing into other products. Processing of fruits and vegetables into various forms is also a way of increasing their shelf life.Puree, sauce, ketchup, pickles are some of the products prepared from fresh tomato, but they have been found to have shorter shelf life because of their high moisture content (Sarker *et al.,* 2014). Although, studies have shown that processing may have adverse effects on food nutrients (Audrey *et al.* 2006: Andritsos *et al*., 2003), however, if processing conditions such as drying temperature are properly controlled, processed food would retain substantial amount of nutrients compared with the fresh product (Iyanda *et al.,* 2014;

Gracia *et al.,* 2010; Idah *et al.,* 2010; Andritsos *et al*., 2003; Bello, 1999).

Drying is a very good means of preserving these perishables if applicable dryers are used. Dried products keep longer and thereby reducing wastage as a result of spoilage. Dried fruits are lighter in weight, can easily be transported and if properly processed, have good nutritional value compared with the fresh fruits. Also, dried fruits are easy to store (Bello, 1999) either in whole or in powdered form. Tomato powder can be stored for as long as one year in polyethylene bags (CTA, 2008). In this study, locally sourced tomatoes were processed into powder and the effect of different packaging materials on the sensory attributes and shelf life of tomato powder was investigated.

METHODOLOGY

Fresh, ripe and matured tomatoes were obtained from the local market in Nigeria. The tomatoes were washed in running water to remove surface dirt and dust and then wiped with muslin clothe to eliminate surface moisture. The clean tomatoes were cut into thin slices of 5mm thickness. The tomato slices were pre treated by dipping them in 1% $CaCl_2$solution and 1% KMS solutionfor 10 minutes at room temperature. 200g of each of the treated sample was dried in the cabinet dryer at 60^0C (as recommended by Iyanda *et al.,* 2014, and Sarker *et al*., 2014) until equilibrium moisture was attained. The dried samples were ground using a laboratory processor. The proximate analysis and analysis of β-Carotene content of the ground sample was carried out. Finally, the tomato powder was packed into three different packaging materials; Black polyethylene [BPE], White polyethylene [WPE], and Laminated Aluminium Foil [LAF] pouches for a period of 6 weeks. Samples were drawn from each pouch after 2 weeks, 4weeks and 6weeks and the proximate analysis was repeated.

The tomato powder was analysed to determine the moisture content, fat, crude fibre, crude protein, vitamin C and total ash using the AOAC method and carotene contents were determined by High Performance Liquid Chromatography (HPLC) method (as described by Charanjeet *et al.,* 2004).

RESULTS AND DISCUSSION

Table 1 shows the chemical composition obtained from the analysis offreshly prepared tomato powder while table 2 shows the changes in the constituent of the tomato powder as drying progressed from week 0 to week 6. From table 1, it can be seen that a moisture content of 12.5%, protein 13.26%, fat 3%, ash910.2%, vitamin C 40.5mg/100g and β-carotene of 4.8 mg/kg was obtained. These values are within the ranges of values obtained by sarker *et al.,* 2009; Reo *et al.,* 2011 and Negi and Roy 2003. The slight variations may be due to the different sources of the tomatoes used and probably a difference in variety.

Moisture Content

From table 2, it is observed that the moisture content increased as the duration of storage increased from week 0 to 6 despite the packaging materials. The moisture content of the powder stored in the laminated polythene foil (LAF) was the most stable as moisture content remained the same for the first 4 weeks of storage with only a slight increase of 2.4% at week 6. Moisture content increased most in WPE with 4% increase at week 2, 10.4% increase at week 4 and 16% increase at week 6 which was the highest obtained throughout the duration of storage. Moisture content increased in WPE by 4%, 5% and 8% at week 2, week 4 and week 6 respectively. From this it can be established that storage duration and packaging material have great effect on moisture content of powdered tomato. This also shows that tomato powder is highly hygroscopic and must be stored in a suitable packaging material to reduce or prevent absorption of moisture.

Protein

Table 1 shows that a protein content of 13.3% was present in the freshly prepared tomato powder. This is slightly lower that the result obtained by Mozumder *et al.,* 2012 for tomato powder pre treated with $cacl_2$ and KMS which was 13.9%. Table 2 shows that protein content reduced as storage duration increased. Protein content decreased from 13.3 to 12.5 in LAF, 13.3 to 11.0 in BPE and from 13.3 to 10.5 in WPE for the entire duration of storage (6weeks). LAF retained the protein constituent best among the three storage materials under investigation in this study. This is in agreement with the findings of sarker *et al.,* 2014.

Fat

From table 1 it can be seen that the fat content obtained from the analysis of the freshly prepared tomato powder was 3g/100g. This is similar to the result obtained by Idah *et al.,* 2010 when tomato was dried at 30^0C but higher that the result of Sarker *et al.,* 2014 (2.1) and Mozumder, 2014 (2.7). Table 2 shows that fat content decreased as storage duration increase for all the packaging materials. However, there was no further decrease in values from week 4 to week 6 in LAF. Also, LAF retained the highest amount of fat at the end of the 6 weeks storage.

Ash

The ash content obtained from the tomato powder is 10.2g/100g as indicated in table 1. This is slightly lower than the result obtained by Mozumder *et al.,* 2012 (10.4) but higher than that obtained by Sarker *et al*., 2014. Table 2 shows that ash content increased slightly in all packaging materials for the period of storage. The increase was quite uniform for all the packaging materials after the 6 weeks storage; LAF (10.8), BPE (10.7) and WPE (10.8).

Vitamin C

From table 1, tomato content of 38.5mg/100gwas obtained for the sample. This is greater than what was obtained by Iyanda *et al.,* 2014; sparkler *et al.,* 2014 and Idah *et al*., 2010 for tomato dried at 60^0C, 60^0C and 90^0C respectively. Vitamin C is one of the most important constituent of tomato hence it is highly desired to have it retained as much as possible during and after processing. The value obtained shows that the treatment applied and procedure for drying are very much desirable and advantageous for retaining the vitamin C content. Table 2 shows that the vitamin C content reduced slightly as the storage duration increases but there was no significant reduction in value in all the packaging materials used. This shows that vitamin C content is not affected by the packaging material but this may be affected after avery long storage duration.

Table 1: Composition of Tomato Powder

Parameters	Quantity
Moisture (%)	12.50
Protein (%)	13.26
Fat g/100g	3.00
Ash g/100g	10.20
Vitamic (mg/100g)	38.50
β-carotene (g/100g)	4.82

Table 2: Moisture, protein, fat, ash, Vitamin C of tomato powder in three packaging materials during storage

Parameters	storage period (weeks)									
	LAF				BPE			WPE		
	0	2	4	6	2	4	6	2	4	6
Moisture (%)	12.5	12.5	12.5	12.8	12.8	13.1	13.5	13.0	13.8	14.5
Protein(%)	13.3	13.2	12.9	12.5	13.0	11.6	11.0	12.4	11.5	10.5
Fat(%)3.0	3.00	2.72	2.10	2.10	2.6	2.0	1.88	2.5	1.7	1.4
Ash (%)	10.2	10.2	10.6	10.8	10.2	10.3	10.7	10.3	10.4	10.8
Vit C	38.5	38.5	38.5	38.3	38.5	38.5	38.2	38.5	38. 3	38.3
β-carotene	4.8	4.3	3.5	2.9	4.1	3.5	2.2	3.8	2.4	1.9

CONCLUSION

Storage of tomato to extend its shelf life is an important aspect of tomato value chain. Tomato powder is a great alternative to tomato pastes and purees which cannot be stored as long as tomato powder. However, the packaging material for storage plays an important role in retaining the proximate composition for the period of storage. Laminated Aluminium foil (LAF) is a good packaging material for tomato powder as it retains to a reasonable extent it's moisture, vitamin C, protein and ash content.

RECOMMENDATION

The duration of storage plays an important role in the retention of the nutrients in stored tomato powder hence; it is recommended that further research be done on the appropriate storage duration suitable for thesafe and beneficial consumption of stored tomato powder.

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