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DETERMINATION OF TOMATO POWDER SHELF LIFE STORED AT AMBIENT TEMPERATURE

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Abstract
Though post-harvest losses of tomatoes cannot be eliminated, but applying appropriate post-harvest technologies can reduced this to a certain limits. Extending the shelf life of tomatoes is very important for domestic and export marketing, which can be achieved through different preservation techniques such as manipulation of storage temperature and relative humidity, addition of chemical preservatives, protection against air/germ pollution through waxing, dehydration and processing into other products. This work investigates the shelf life of tomato powder stored at ambient temperature. Fresh tomatoes sliced vertically into four; was oven dried and blended into powder. Proximate analysis was carried out on the powdered tomato and fresh tomato as the control sample to ascertain the effects of drying on its nutritional values. The remaining part was tied inside a transparent polyethylene nylon and placed on shelf in the laboratory to quarterly check for any physical and nutritional changes. Results obtained show that for maximum retention of hygienic and nutritional qualities (protein, fat, crude fibre, carbohydrates and energy contents, etc.) without adding preservatives or pre-treatment, freshly prepared tomatoes powder can be stored in an air tight polyethylene nylon at room temperature for a viable period of between three to six months.

Key Words: *Tomatoes, Post-harvest, Ambient Temperature, Proximate Analysis, Shelf life.*

1.0. INTRODUCTION

Tomato (*Lycopersicon eculentum L.*) is grown throughout the world, with an annual production that exceeded 170 million tons in 2014. Nigeria has harvested area of 541,800 Ha, the largest in Africa (FAOSTAT, 2014; Sahel Research, 2015). Tomato fruits can be consumed as fresh vegatable or processed to other valuable products such as peeled tomato (whole or diced), juices, sauce, ketchup, tomato paste, pulp and puree (Rock *et al.,* 2012). Tomato is rich in many chemical compounds that are of great benefits to human welbeing and existence. Such compounds include carotenoid, a natural pigments with health-beneficial properties, which are accumulated in the chloroplasts and chromoplasts of several fruits during ripening (Pataro *et al*., 2015; Singh *et al*., 2015). Lycopene is the most abundant carotenoid in tomato processing by-products. In particular, it accumulates in the peels, at concentrations about five times higher than in tomato seeds and pulp (Knoblich *et al.,* 2005; Strati and Oreopoulou, 2014; Luengo *et al*., 2014).

The edible part of the fruit is known as the power house of nutrition with an average tomato supplying about 40% of the adult Recommended Daily Allowances (RDA) of 60 mg (Charanjeet *et al.,* 2004). Tomatoes contain a large variety of other important nutrients such as β-carotene, polyphenols, and vitamin C, which are thought to be potent antioxidants. They also contain folate, which could contribute to their beneficial effects (Martínez-Valverde *et al*, 2002; Periago *et al*, 2008).

Tomato with all the inherent benefits, is very perishable having a short life span of usually 2-3 weeks, and change continuously after harvesting. Depending on the humidity and temperature it ripens very soon, ultimately resulting in poor quality as the fruit become soft and unacceptable (Opadotun, *et al*., 2016). About 40-50% of tomato produced in Nigeria is lost due to the poor handling, processing, preservation practices and transportation media in Nigeria (Sahel Research, 2015). Post-harvest losses of tomatoes cannot be eliminated, but reduced within certain limits by applying appropriate post-harvest technologies. Due to lack of effective preservation techniques farmers cannot preserve fresh tomatoes for longer periods (Sarker, *et al*., 2014). Extending the shelf life of tomatoes is very important for domestic and export marketing and to make the product available throughout the year. To increase the shelf life of tomatoes, different preservation techniques can be employed such as manipulation of storage temperature and relative humidity, addition of chemical preservatives, protection against air/germ pollution through waxing, dehydration and processing into other products. Generally, shelf life of tomatoes is extended by low

temperature storage. Post-harvest recommendations indicate that tomatoes should be stored at 10°C or higher to avoid chilling injury but this temperature may be detrimental to tomato flavour quality (Maul *et al.*, 2000; Roberts *et al.*, 2002). Sarker et al. (2014) affirmed that with pre-treatment of 1% $CaCl_2$ + 0.2% KMS prior to drying at 60C, powdered tomato can be stored for six months in laminated aluminium foil (LAF) at room temperature. Dehydrating tomatoes using sun, electric dryer/oven or dehydrator is another simple and easy way to store them. When properly dried (dry but pliable) and stored in airtight containers, tomatoes will last over a year making it convenient and available for snacking and culinary use. Sun, a natural resource abundantly available in Nigeria can be employed by farmers in drying fresh tomatoes. But this should be done in a hygienic and controlled environment free from dust, sand, flies and other contaminants, which in most time is the case.

In this investigation, fresh tomatoes were vertically sliced into four, oven dried and blended into powder. Proximate analysis was carried out on the powdered tomato and fresh tomato as the control sample to ascertain the effects of drying on its nutrients. The remaining part was tied inside a transparent polyethylene nylon and placed on shelf in the laboratory to intermittently (quarterly) check for any physical and nutritional changes. This is to help predict correctly the viability shelf life of powdered tomatoes stored at ambient temperature without adding any chemical preservatives.

2.0. MATERIALS AND METHODS

2.1 Materials

These materials were of utmost importance in the investigations, namely fresh San Marzano variety tomatoes, electric oven, digital weighing scale, electric blender, knife, cutting board, spatula, reagents, test tubes, and airtight containers.

2.2 Sample Preparation

Fresh San Marzano variety, popularly called “Hausa Tomatoes” was sourced from Mandate Market, Ilorin, Kwara State. It was washed and divided into three parts. Sample A- fresh tomatoes served as the control while sample B- 5 kg of the tomato was oven dried. The fresh tomatoes (sample A) was blended and analyse immediately for its nutritional values. Sample B was sliced vertically into four parts and dried inside a Heraeus DVC (0-300C) electric oven at 60C for seventy-two hours. The fresh tomatoes was dried from 94.14% moisture content to 8.67%. The dried sample was blended into powder and divided into two sample labelled B_1 and B_2. Sample B_1 was analyse immediately for nutritional values while sample B_2 was stored inside an air tight polyethylene for a period of nine months. Sample B_2 was analysed

every 3 months (quarterly) to determine variations in its nutritional values in order to ascertain its suitability for consumption.

Plate: Oven drying of fresh tomatoes in the laboratory.

2.3 Experimental procedures

The chemical analysis of percentage crude protein, crude fibre, moisture, ash, lipids, carbohydrate contents and energy value were carried out using methods described by Ibitoye (2005). The crude protein was obtained by determining the organic nitrogen content of the sample using micro-Kjeldah method and multiplying the nitrogen by a protein conversion factor which is usually 6.25. The ash content of the sample was estimated by igniting the weighed sample in the weighed crucible at a temperature of 500°C for about 3 hours in a muffle furnace, while the moisture content was determined using oven method. The crude fibre and fat determination were done by hydrolysing the sample with 0.128 ml of H_2SO_4 and 0.223 ml of KOH and Soxhlet extraction method, respectively. The difference in crude and fat fibre content gave the carbohydrate content of the sample. The energy values of the samples were calculated from the summation of percentage proteins multiply by 4, percentage lipids multiply by 9 and percentage carbohydrates multiply by 4 (AOAC, 2012).

3.0. RESULTS AND DISCUSSIONS

3.1 Effect of storage time on shelf life of powdered tomato

Changes in measured parameters namely moisture, protein, fat, ash, lipid, carbohydrates and energy (calories) observed during the storage period are presented in table 1.

Table 1: Proximate Composition of Fresh and Powdered Tomatoes.

Parameter	A(Fresh)	B_1(Dried)	B_2 (Dried)		
			1st Quarter	2ndQuarter	3rd Quarter
Proteins (%)	28.97	13.25	10.05	5.67	0.25
Lipids (%)	1.77	1.19	1.05	0.85	0.70
Moisture content (%)	94.14	8.67	9.42	9.89	10.05
Fibre (%)	0.19	0.28	6.78	10.29	19.08
Ash (%)	20.19	49.36	52.25	58.96	62.17
Carbohydrates (%)	8.75	27.27	19.87	15.24	7.85
Energy (Calories)	166.85	198.39	131.23	86.19	34.50

3.1.1 Effect of storage time on the moisture content of the stored powdered tomato

Significant changes were observed in moisture content during the storage period. The highest moisture content of 10.05% was recorded in the third quarter compared to the value of 8.67% of the freshly prepared tomato powder. This is lower than 18.03% value reported by Rao *et al*. (2011) for tomato powder stored in polyethylene over six months period and in range with the value (9.45%) reported by Sarker et al. (2014) for tomato powder stored in Medium Density Polyethylene (MDPE). Moisture content tends to increase as the storage time increases.

3.1.2 Effect of storage time on the protein content of the stored powdered tomato

There was a sharp decrease in protein content of the tomato powder from 13.25% freshly prepared powder to 0.25% at the 3rd quarter. This result conforms to the findings of Guyana (2010) that degradation rate of agricultural products depends on moisture content. This shows an inverse relationship between moisture content and protein content of the stored powder tomato.

3.1.3 Effect of storage time on the lipid content of the stored powdered tomato

Decreased in lipid content from1.19% (freshly prepared powder) to 0.70% (3rd quarter) this was as a result of the high rate of degradation imposed by the increase in moisture content.

3.1.4. Effect of storage time on the ash, fibre, carbohydrates and energy content of the stored powdered tomato

Ash content increased over the period of storage from 49.36% (freshly prepared powder) to 52.25, 58.96 and 62.17% for the 1st, 2nd and 3rd quarters respectively. This trend is similar to what Sarker, *et al*. (2014) reported for tomato powder stored in various density of polyethylene over a period of six months. There was a significant increase in the crude fibre content from 0.28% to 6.78, 10.29 and 19.08% respectively for the three quarters under review. This indicates deterioration in nutritional content over the storage period. Carbohydrate and energy content both decreased over the period of storage with cabohydrates decreasing from 27.27% (fresh powder) to 7.85% (3rd quarter) while energy reduced from 198.39 Calories to 34.50 Calories in the third quarter.

3.1.5 Effect of storage time on the physical appearance of the stored powdered

There was no marked physical degradation (colour change) observed in the first and second quarters but a slight change of colour and mouldy growth was observed in the third quarter of this investigation.

Conclusion

The study investigated the effect of storage time on the shelf life of tomato powder stored at ambient temperature. The investigations shows an increase in moisture, fibre and ash content as the storage time increases but protein, lipid, carbohydrate and energy content decreases with increased storage time. It was established from this investigation that for maximum hygienic and nutritional value like protein, fat, crude fibre, carbohydrates and energy contents, etc. to be retained without adding preservatives or pre-treatment, freshly prepared tomato powder may be stored in air tight polyethylene nylon at room temperature for a viable period of between three to six months.

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