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Full Length Research Paper

Comparative Analysis of Nutritional Values of Tomatoes Subjected to Different Drying Conditions

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Abstract
Tomatoes are consumed widely throughout the world. The edible part of the fruit is known as the power house of nutrition. It is one of the very perishable fruit; being a climacteric and perishable vegetable, tomatoes have a very short life span, usually 2-3 weeks. It changes continuously after harvesting. The quality of tomato is determined by colour, appearance, flavour and firmness. As important as this fruit is, the post harvest losses are estimated to be 5 to 25% in developed and 20 to 50% in developing countries. One simple and easy method to store tomatoes is to dehydrate them, either via the sun or with an electric oven or dehydrator. This work goes further from drying tomatoes to grinding the dried tomatoes into powder using two different drying methods: sun drying and oven drying. Three samples: A-Fresh Tomatoes (Control), B- Sun dried and C- Oven dried were used for the experiment. A comparative nutritional analysis of the end products was carried out to know which one retains nutrient better using the fresh tomatoes (Sample A) as reference. This investigation showed that the tomatoes dried under a controlled environment can be preserved longer than sun dried sample due to lower moisture content which will inhibit microbial activities that destroy stored food products; though sample B (sundried) slightly retained some nutritional constituents (lipids, crude proteins and carbohydrates) than C (oven dried).

Key words: *Comparative, analysis, nutrition, microbial and drying.*

Introduction

The common garden tomatoes (*Solanum lycopersicom*) are botanically classified as a fruit. Actually it is a berry, but many people think of it as a vegetable. The U.S department of Agriculture, for example, has defined it as a vegetable belongs to Solanaceous family. More than 2000 varieties are grown all over the world. The modern tomato originated in the Southern region of the Andes Mountain, the costal deserts of Peru, and Ecuador and parts of Central Mexico. Tomato is one of the important cash crops in many countries. In terms of per capita consumption, tomato is the leading processed vegetable. The main producers and exporters in the world are China, USA, Turkey, Egypt and India (USDA, 2007).

Tomatoes are consumed widely throughout the world. The edible part of the fruit is known as the power house of nutrition (Tyssandier *et al.,* 2004; Weisburger, 2002) and their consumption has recently been demonstrated to possess health benefits because of their rich content of phytonutrients (Hsu *et al*., 2003) with an average tomato supplying about 40% of the adult United States Recommended Daily Allowances (RDA) of 60 mg (Charanjeet *et al.,* 2004).Tomatoes also 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). It is used as a fresh vegetable as well as raw material in food industry for products such as ketchup, tomato juice, pulp and puree and tomato paste.

Tomato is one of the very perishable fruit; being a climacteric and perishable vegetable, tomatoes have a very short life span, usually 2-3 weeks. It changes continuously after harvesting. Depending on the humidity and temperature it ripens very soon, ultimately resulted in poor quality as the fruit become soft and unacceptable. The quality of tomato is determined by colour, appearance, flavour and firmness. Colour of tomato is very important in determining its quality (Opiyo et al, 2005).

As important as this fruit is, the post harvest losses are estimated to be 5 to 25% in developed and 20 to 50% in developing countries (Kedar *et al* 1985). Hence the need to preserve it.

About 50% of perishable food commodities including fruits, vegetables, roots and tubers are lost after harvest in West Africa. [Onebunne, 2004].The post-harvest handling of tomatoes is important because of perishable nature. As such they continue to undergo both desirable and undesirable changes during handling. Post-harvest losses in tomatoes cannot be eliminated, but can be reduced within certain limits by applying appropriate post-harvest technology. Extending the shelf life of tomatoes is very important for domestic and export marketing.

Generally, shelf life of tomatoes is extended by low temperature storage. Postharvest recommendations indicate that tomatoes should be stored at 10°C or higher to avoid chilling injury (Roberts *et al.,* 2002) and even 10°C may be detrimental to tomato flavour quality (Maul *et al.,* 2000).Another simple and easy method to store tomatoes is to dehydrate them, either via the sun or with an electric oven or dehydrator. If tomatoes are properly dried – dry but pliable – and stored in airtight containers, they will last over a year and will be convenient and available for snacking and culinary use. Sun drying can take a little extra effort and monitoring, as temperature fluctuations, humidity, and changing weather conditions can affect your end result. It can sometimes take a number of days to fully sun-dry tomatoes. Also tomatoes can be pasted and canned in air tight container to prevent microbial activities thereby increasing the shelf life (Jason, 2012).

Table 1 Post harvest losses of vegetables/ tomatoes in different countries.

Country	Indonesia	Japan	Nepal	Pakistan	Philippines	Sri Lanka	Thailand	USA
Loss (%)	20 – 50 (Tomatoes)	10 (Tomatoes)	27 (Vegetables)	21 – 37 (Vegetables)	22 – 32 (Tomatoes)	45 (Vegetables)	20 (Tomatoes)	12 (Tomatoes)

Source: (APO, 1989).

There is a rapid development of tomato processing industries in recent decades with a series of interlinked activities such as production of salad, soup, juice, puree, paste and powder and extraction of oil from the pulp and the demand for dehydrated tomato is increasing rapidly both in domestic and in international market with major portion of it being used for preparation of convenience food since it has limited shelf life and highly perishable at ambient conditions (Purseglove *et al.,* 1981).

The main objective of this research is to dry wholesome tomato fruits by subjecting it to different drying methods namely, sun drying and oven drying. Blend the replicates into powder and find out whether the drying processes affect its nutritional values by subjecting them to a proximate analysis using freshly blended raw tomatoes as control sample.

Materials and Methods

Materials

Fresh San Marzano variety tomatoes, digital weighing scale, electric oven with thermometer, electric blender, knife, cutting board, spatula, reagents, test tubes etc.

Sample preparation

The fresh San Marzano variety (Hausa Tomatoes) was sourced from Mandate market, Ilorin, Kwara State. The tomatoes were washed and shared into three parts, a portion was set aside as the control and tagged sample A; two 5Kg of the sample were weighed out and tagged B and C respectively.

A- Control sample (fresh tomatoes), B- Sun dried tomatoes, C- Oven dried tomatoes. Sample A was blended and preserved for the experiment. Sample B was sliced horizontally with slice thickness of 10-20mm and sun dried for about five days. The dried sample was then blended into powder and stored inside air tight container and kept in a desiccator to prevent moisture absorption from air. Sample C was sliced vertically and oven dried at 65° C for 72 hours. The end-product was also blended into powder and kept in desiccator as well.

Experimental procedures

The chemical analysis of percentage crude protein, crude fibre, moisture, ash, lipids and carbohydrate contents 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 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 hydrolyzing the sample with 0.128 ml of H_2SO4 and 0.223 ml of KOH and Soxhlet extraction method, respectively. The carbohydrate content was determined by their differences. (AOAC, 2012)

Results and Discussion

The mean value of the **moisture content** for samples A, B and C were 40.14±0.01, 9.04±0.03 and 8.67±0.01 % respectively. This also showed that tomatoes dried under a controlled environment (C) i.e. oven dried gave a better result compared to the sun dried (B) because of the controlled temperature and humidity. This will enhance the shelf life of sample C with lower moisture content after drying to store longer than sun dried sample.

There was a significant increase in the *ash content* value with decrease in the moisture content as shown in the result with samples A, B and C having a mean value 20.19±0.00, 42.75±0.01 and 49.36±0.00 % respectively. Sample C retained ash than B. This was similar to USDA (2008) comparism of nutrition value for sun dried and fresh tomatoes which gave 12.6% for sun dried and 1.44% for fresh.

The *lipids content* had a mean value of 1.77±0.01, 1.27±0.01 and 1.19±0.01 % for samples A, B and C respectively. This shows that the lipids content decreased with the decrease in moisture content. With sample B having more lipids than C. USDA (2008)

reported an increase in lipid content with a decrease in moisture content in its comparism of nutrients of sun dried and fresh tomatoes.

The *crude proteins* content also decreased with decrease in the moisture content, this reveals that sun dried tomatoes retained proteins more than the oven dried. The mean of the results were 28.97±0.00, 15.81±0.01 and 13.25±0.01% for A, B and C respectively. USDA (2008) reported an increase in crude proteins content in its report on the comparism of fresh and sun dried tomatoes.

The results showed that the *fibre content* increased slightly with decrease in moisture content, hence, the fibre content of sample C is higher than B and B than A in that order. The mean values were 0.19±0.01, 0.21±0.01 and 0.28±0.00 % for sample A, B and C respectively. This was similar to the findings of USDA (2008) which also reported an increase in fibre content with reduction in moisture.

The mean of the *carbohydrates content* were 8.75±0.02, 30.93±0.04 and 27.27±0.01 % for A, B and C respectively. There was a significant increase in the *carbohydrates content* with reduction in moisture content considering the difference in the carbohydrates value for the fresh tomatoes (A) and the dried samples B and C. Sample B retained this nutrient better than C though. USDA (2008) reported a similar result for the carbohydrate content of sun dried (19%) and fresh tomatoes (3%).

Table 2: The mean of the nutritional values of the Tomato Samples.

Parameters	Sample a	Sample b	Sample c
Moisture content (%)	40.14±0.01	9.04±0.03	8.67±0.01
Ash content (%)	20.19±0.00	42.75±0.01	49.36±0.00
Lipid content (%)	1.77±0.01	1.27±0.01	1.19±0.01
Crude protein content (%)	28.97±0.00	15.81±0.01	13.25±0.01
Crude fibre content (%)	0.19±0.01	0.21±0.01	0.28±0.00
Carbohydrate content (%)	8.75±0.02	30.93±0.04	27.27±0.01

Sample a: *control sample (fresh tomato blend).*
Sample b: *sun dried.*
Sample c: *oven dried.*

Conclusion and Recommendation

The results of these investigations showed that the tomatoes dried under a controlled environment can be preserved longer than sun dried sample due to lower moisture content. This will inhibit microbial activities which destroy stored food products. Though the sundried sample (B) slightly retained some nutritional constituents (lipids, crude proteins and carbohydrates) than oven dried sample (C) but there should be further investigation to determine the level of microbiological contaminant introduced by these methods of drying and determine how long each of these samples retain their nutritional values and their storage capacity (shelf life).

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