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COMPARATIVE STUDY OF PROXIMATE AND MINERALS COMPOSITION OF TOMATO CULTIVARS IN SOKOTO, SOKOTO STATE, NIGERIA

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ABSTRACT
Tomato fruits are one of the most commonly consumed vegetables worldwide for their health as well as nutritional benefits. However, the fruits contain a lot of water which predisposes them to spoilage by microorganisms that makes its storage and transportation difficult. In the present study, the work was carried out to determine the proximate and minerals composition of three tomato fruits cultivars namely: DanEka, Bahaushe and UTC grown in Sokoto, Sokoto State, Nigeria. Tomato samples were collected from different sales outlets (Kasuwar DanKure and Kasuwar Daji) in Sokoto metropolis and were analyzed for proximate and mineral contents using standard laboratory procedures. Results showed that UTC had highest proteins (1.68%), carbohydrates (91.52%), magnesium (3.6 ppm), sodium (14.0 ppm) and potassium (0.994 ppm) contents but was the least in moisture (90.2%), crude fat (0.2%) and calcium (1.5 ppm). On the other hand, DanEka was observed to have least protein (0.70%), carbohydrates (89.08%), ash (0.02%), magnesium (2.7 ppm) and phosphorus (0.795 ppm) but had the highest moisture (95.2%) and calcium (1.6 ppm) contents. Conversely, the highest crude fat (4.0%) and least sodium (8 ppm) contents were recorded in Bahaushe. It was however moderate in moisture, carbohydrates, protein, magnesium and phosphorous. The proximate compositions have shown that the cultivars were of high nutritional quality and UTC could stand longer postharvest storage period considering its lower moisture content.

Keywords: DanEka, Bahause, UTC, Proximate, Mineral, Cultivars

INTRODUCTION

Tomato (*Lycopersicum esculentum* L.), is a dicot plant that belong to the family solanaceae. Tomato fruit may be pear, elongated, flattened or heart shaped. It is widely distributed in nature and is considered commercially important and nutritionally essential food commodity (Hayes, 2005). Tomato fruits are natural food of humans which contains considerable quantities of essential nutrients in a major proportion and prevent diseases Zahir *et al*. (2009). Tomato is widely eaten in both raw and processed forms Moneruzzaman (*et al*. (2008). It is rich in vitamin A and vitamin C, carbohydrates, proteins, fats, fibres and potassium (Orji, 2015). Consumption of tomato fruits is believed to benefit the heart and other organs. The richest source of lycopene is tomato and tomato-based products Evangelia *et al*. (2005). Lycopene has been found to prevent prostate cancer, improve the skin's ability to protect itself against the harmful ultra violet rays, decrease the risk of breast, lung, stomach, bladder, uterine, head and neck cancers, protect against neuodegenerative diseases, lower urinary tract infections and reduce the cardiovascular risk associated with type 2 diabetes (Freedman *et al*., 2008 and Shidfar *et al*., 2010).

The relatively low production of tomato in Nigeria as compared to Asia, Europe, North and South America is attributable to biotic, social and environmental constraints. Prominent among such constraints are pests and diseases which reduce yield and the quality of marketable fruits. In the tropics, particularly in Nigeria, many insect pests are associated directly with tomato damage and yield losses, while others are important as vectors of diseases (Anonymous, 1986; Messiaen, 1992; Tindall, 1977; Umeh and Oyedun, 1995). Global postharvest losses of tomato are as high as 30-40% (Agrios, 2005; Kader, 1992), but this is much higher in developing countries like Nigeria due to improper handling procedures and lack of methods to prevent spoilage Prigojin, *et al*. (2005). Fruits, by nature have low pH, higher moisture content and nutrient composition, and these inherent attributes renders them very susceptible to attack by pathogenic fungi,

which in addition to causing rots may also make them unfit for consumption by producing mycotoxin (Philips, 1984; Moss, 2002; Stinson *et al*., 1981). Fungi are the most important and prevalent pathogens, infecting a wide range of fruit and causing destructive and economically important losses of fruits during storage, transportation and marketing. Postharvest tomato damage due to microbes is depending on the variety of the tomato Etebu, Nwauzoma and Bawo (2013).

In Nigeria, large quantity of tomato are produced in million tones, 1.8 million tones is estimated annual production (Ugonna *et al*., 2015). Farmers in Sokoto State are among the major cultivators of tomatoes in Nigeria especially during the dry season. Tomato production in Sokoto State is an important business because it provides a means of livelihood to the people. It also contribute to economy as it serves as important source of income of both the rural (farmers) and urban (traders) dwellers. Despite the Government's effort to revitalize agriculture for food security and sustainability, tomato production is hampered with challenges including spoilage. As tomato contains large amount of water, it is speculated that the water content and abundant nutrients makes it more susceptible to spoilage by the action of microorganisms (Bai and Lindhout 2006). Several reports on the tomato spoilage has been reported in Sokoto State but there is scarcity of information on the proximate composition and mineral content of different tomato cultivars in Sokoto State Nigeria. This called for the need to determine nutritional composition and mineral content of different tomato fruits cultivated in Sokoto in order to provide an insight into its composition.

MATERIALS AND METHODS

Samples Collection

Samples of physically healthy tomato fruits of "DanEka", "Bahaushe" and "UTC" were collected from Kasuwar Daji and Kasuwar Dankure, Sokoto, Sokoto State. Kasuwar Daji and Kasuwar Dankure were the largest and the most popular market (in terms of the sales of foodstuff) in the entire Sokoto metropolis. Thirty (30) Sample of each variety was collected in a separate sterile polythene bag and transported to the Herbarium Laboratory of Botany Unit, for identification. Samples were then taken to Agricultural chemical laboratory of Usman Danfodiyo University Sokoto for proximate and minerals analysis.

Proximate and Minerals Analysis

Determination of moisture content

The moisture content was determined following AOAC method (AOAC, 2000)5g of the freeze dried sample was heated in a hot air oven at 105°C for 2 h, cooled in desiccator, weighted and the moisture content was calculated by the following formula.

$$\text{Moisture (\%)} = \frac{\text{Weight of sample} - \text{Dry weight}}{\text{Weight of sample taken}} \times 100$$

Determination of ash content

The ash content was determined by the AOAC method (AOAC, 2002). Silica crucible was first heated in a muffle furnace, cooled in a desiccator and the initial weight was taken. 5 g of the sample was heated in a muffle furnace at 550°C for 6 h, cooled in desiccator, weight of the ash was taken and ash content calculated.

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of the sample}} \times 100$$

Determination of crude fat

The crude fat content was determined following Association of Official Analytical Chemists method (AOAC, 2002). The initial weight of the flask was taken by heating in a hot air oven for overnight at 105°Cfollowed by cooling in a desiccator. 5 g of the sample was extracted with petroleum ether using Soxhlet apparatus for about 6 h. The extracted fat was dried in a rotary evaporator and the weight was measured.

$$\text{Crude fat (\%)} = \frac{\text{Weight of ash}}{\text{Weight of the sample}} \times 100$$

Determination of crude protein

Crude protein was determined by Kjeldhal method following the (AOAC, 2002) method, 2g of the sample was digested with 20 mL concentrated H_2SO_4 and Kjeldhal catalyst (9 parts of K_2SO_4 and one part of $CuSO_4$) in a digestion chamber until it becomes clear. The blank test was performed without the sample. After digestion, it was distilled in Kjeldhal distillation chamber (Buchi

Kjelflex K-360). The evaporated ammonia was condensed and then titrated against the known concentration (0.1 N) of HCl. The concentration of nitrogen was calculated by the following formula.

$$\text{Nitrogen (\%)} = \frac{(A - B) \times N \text{ of HCl} \times 14}{\text{weight of sample}} \times 1000$$

Determination of crude fibre

Crude fibre was also determined according to (AOAC, 2002) method. 1 g of the dry sample was boiled with 0.25 N H_2SO_4 for 30 min followed by filtration with muslin cloth, washed with hot water and again boiled with 0.313 N NaOH. It was again filtered, washed with hot water followed by 0.5 N H_2SO_4 and 50% ethanol. The residue was dried in an oven at 130 °C for 2 h. The dry weight of the digested sample was taken, incinerated in a muffle furnace at 600 °C for 30 min, cooled in a desiccator and weight of the ash was measured. The crude fibre content was calculated based on 100 g of the freeze dried sample using the following formula.

$$\text{Crude fibre (\%)} = \frac{\text{Dry weight of digested sample} - \text{weight of ash}}{\text{Weight of the sample}} \times 100$$

Determination of total carbohydrate

The total carbohydrate content was determined by the difference method (James, 1995) according to the following formula.

Carbohydrate (%) = 100 – (Moisture (%) + Ash (%) + Crude protein (%) + Crude fat (%)).

Minerals determination

Minerals such as sodium, potassium, calcium, magnesium and phosphorous was determined using Atomic Absorption Spectrometre (AAS-3500, thermo Scientific, UK). Sample was digested using wet ashing method with concentrated HNO_3. A result obtained was converted to ppm/100g of freeze dried sample.

RESULTS AND DISCUSSION

Table 1 below shows the proximate composition of three varieties of tomato cultivars collected from Sokoto metropolis, the results revealed that DanEka has the highest moisture contents of 95.2%, followed by Bahaushe with 92.8% and UTC with 90.2%, respectively. Bahaushe and UTC have the highest crude ash with 1.2% each whereas DanEka had only 0.02%. Similarly, the result also showed that Bahaushe has the highest crude fat of 4.0%, followed by DanEka (2.0%) and UTC (0.2%). Conversely, the highest crude proteins of 1.68% were recorded in UTC which was as twice as that in Bahaushe (0.81%) and DanEka (0.70%). On the other hand, DanEka has the highest crude fibre (8.2%), followed by UTC and Bahaushe with 5.4% and with 3.2% respectively. The carbohydrate contents in UTC was the highest content (91.52%), followed closely by Bahaushe (90.79) and DanEka (89.08%).

Table 1: Proximate composition of tomato cultivars in sokoto

Cultivars	%Moisture content	%Crude Ash	%CrudeFats	%Crude Protein	%Crude Fibre	% Carbohydrate
DanEka	95.2	0.02	2	0.70	8.2	89.08
Bahaushe	92.8	1.2	4	0.81	3.2	90.79
UTC	90.2	1.2	0.2	1.68	5.4	91.52

Table 2 below shows the mineral composition of three varieties of tomato cultivars collected from Sokoto Metropolis.The results revealed that UTC has the highest sodium contents with 1.4ppm followed by DanEka 1.3ppm and Bahaushe 0.8ppm respectively. The results also showed that DanEka has the highest potassium with 2.1ppm, UTC 1.7ppm and Bahaushe with 1.3ppm. On the calcium contents, DanEka and Bahaushe has the same contents of 0.16ppm little more than the UTC (0.15ppm). The results for magnesium contents revealed that UTC has the highest content of 0.36ppm, followed by Bahaushe (0.33ppm) and DanEka

(0.27ppm). Similarly), the phosphorous contents in UTC was the highest with (0994ppm) followed by DanEka with 0.0975ppm. Bahaushe was recorded to have the least phosphorous (0.0730ppm) contents.

Table 2: Minerals composition of tomato cultivars in Sokoto

	Mineral contents (ppm)				
Cultivars	**Sodium (Na)**	**Potassium (K)**	**Calcium (Ca)**	**Magnesium (Mg)**	**Phosphorous (P)**
Daneka	1.3	2.1	0.16	0.27	0.0975
Bahaushe	0.8	1.3	0.16	0.33	0.0730
UTC	1.4	1.7	0.15	0.36	0.0994

DISCUSSION

There were significant differences in the proximate and mineral contents among the three major tomato Varieties collected. Among this Varieties UTC has relatively lower moisture content compared to that of DanEka and Bahaushe. High moisture content of fruits is associated with rapid microbial attack due to abundant water activity. Thus, UTC would have longer shelf lives compared to DanEka and Bahaushe Varieties. Various levels of moisture content for tomatoes have been reported and the results of this finding were in conformity with that of Mohammed *et al*. (2017) have reported the moisture contents of the three cultivars with an average level of 90.75±0.03, 88.43±0.04 and 84.15±0.01% for Roma VF, Ronita, and UTC, respectively.

The results showed that there is a generally low percentage ash content in all of the tomato cultivars. Lower content of acid-insoluble ash indicates the presence of a small amount of non-physiological components like silica and silicates whereas higher content of acid-soluble ash suggests larger amount of acid soluble compounds like oxalates, carbonates, phosphates and oxides. This finding is closely in agreement with the results of Islary *et al*. (2016) reported low ash content in the fruits containing salt of metals and trace minerals.

The results of the fat, fibre, and protein and carbohydrate contents of tomato fruits presented showed significant differences among the varieties; UTC has the lowest crude fat this is because it has low moisture content. There is inconsistence in the values obtained in this study for the tomato varieties used; this is in conformity with the finding of Rickman *et al*. (2010)

A part from carbohydrate contents which was not significantly different, tomato varieties varied a lot in terms of nutrient composition such that no single variety was identified with the higher amount of all the nutrients analyzed with the exception of UTC that was analyzed with higher amount of crude protein. This implies that these tomato varieties may be utilized differently.

The mineral composition of tomatoes revealed that UTC tomatoes have the higher concentration of sodium, magnesium and phosphorus this could be due to low fat content. The finding is in conformity with that of Shina *et al*. (2018)

The outstanding values of the tomato as a source of special nutrient needed in the diet are indicated by the nutritive values. All the three tomato varieties are good sources of quality and mineral elements. The variation in the nutritive values of different varieties of tomato used in this study might be due to the size, shape aroma and lycopene contents. Also, distribution of minerals needed for human health in the fruits can be affected by cultural production methods Olaniyi *et al*. (2010).

CONCLUSION

This study revealed that tomato varieties collected from Sokoto markets vary in their proximate and minerals composition. Thus, the overall importance and utilization, especially processing of these varieties could differ. This information is very important as a basis for selection of these varieties for improvement by the breeders. Proximate composition such as moisture, ash, fats, protein and carbohydrate, minerals content such as sodium, potassium, calcium, magnesium and phosphorous. However the three cultivars can serve as a good source of nutrients and minerals.

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