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Comparative Nutritional Analysis of Paste Developed from *Tricosanthes cucumerina Linn* and *Lycopersicon esculentum* L. Mill. in Nigeria

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Abstract

Tricosanthes cucumerina Linn. is one of the indigenous underutilised vegetables found in South-Western Nigeria and is used in rural areas as a substitute for vine tomato (Lycopersicon esculentum L. Mill.) due to its sweet tasting, aromatic, and deep red endocarp pulp. It is known as snake gourd, viper gourd, snake tomato or long tomato in many countries. Little attention is being paid to this crop despite its rich nutrient content and ease of cultivation. This study explored the potential of the crop in development of tomato paste; its beta-carotene, lycopene, vitamin C and mineral content was compared to that of vine tomato paste. The fully ripe fruits of the two vegetables were harvested from a local farm in Ibadan, Nigeria. The pulp of the snake tomato was extracted, concentrated, poured into a sterilized glass jar and corked. As for the vine tomato, wholesome fruits (roma variety) were washed, milled, concentrated, poured into sterilized glass jars and corked. All laboratory analyses were done using standard procedures. Paste from snake tomato had significantly ($p < 0.05$) higher content of β-carotene, vitamin C and lycopene (2.02. 0.30 and 1.34 mg/g respectively) than paste from vine tomato (1.03, 0.14 and 0.42 mg/g respectively). Likewise, mineral elements such as Fe, Zn, Ca and K were significantly ($p < 0.05$) higher in paste from snake tomato (3.44, 0.86, 13.38, and 320.25 mg/100g respectively) than paste from vine tomato (2.69, 0.24, 12.01 and 179.6 mg/100g respectively). However, sodium was significantly ($p < 0.05$) higher in vine tomato paste than snake tomato paste (59.2mg/100g vs 6.35mg/100g). In conclusion, the paste from snake tomato pulp has higher bioactive compounds and minerals than vine tomato paste. These essential nutrients contained in snake tomato make the fruit and its paste of nutritional and health importance. Thus, it can serve as a good substitute or complementary raw material for tomato paste industry.

Keywords: Bioactive component, mineral, tomato paste, underutilised

Introduction

Snake Tomato (*Trichosanthes cucumerina*), also known as viper gourd or long tomato, is a well-known plant, with fruit mainly consumed as a vegetable (Liyanage et al., 2016). It is an annual climber belonging to the family cucurbitacea. It is a tropical or subtropical vine with strikingly long fruit; it is grown for cooking and medicinal purposes. The genus *Trichosanthes* is native to Southern and Eastern Asia, Australia and Islands of the western Pacific. *Trichosanthes cucumerina* is found wild throughout these areas. Some commercial growers in East Africa are able to export the fruits to India (Sandhya et al., 2010**)**. In Southwest Nigeria, it is usually found growing in protected environments in backyards (Adebooye et al., 2001) and is consumed as a vegetable. It is mainly found in the states of Lagos, Ogun, Oyo, Osun, Ekiti, Ondo and Edo of Nigeria. Farmers substitute the pulp for the regular tomato during the period of *Solanum lycopersicum* scarcity (Onagoruwa, 2002).

Many rural households depend on indigenous foods that are available around them; evidence has shown that these foods play an important role in alleviating food and nutrition insecurity and contribute to dietary diversity (Adebooye et al., 2001; Mbhenyane, 2017). These plants lack general acceptability in urban areas despite its rich nutrient composition, ease of cultivation and adaptability to different seasons (Chuku et al., 2008). Snake tomato is one of such crops consumed by rural households. It can also be regarded as an underutilized crop; less attention has been given to its agronomic, economic and nutritional importance. The plant is rich in chemical constituents like flavonoids, carotenoids, phenolic acids which explains its use as a therapeutic plant. Only scanty data exist on the nutritional composition of this plant. In addition, there is little exploration on the use of the crop in the development paste as the case is with normal vine tomato. This study, therefore, developed paste of *Trichosanthes cucumerina* and *Solanum lycopersicum* in order to compare their nutrient composition.

Material and Methods

Ripe, firm snake tomato fruits were harvested at a local farm in Akobo, Ibadan, Oyo State, Nigeria. They were washed, weighed and the pulp (including the seed coat) was carefully separated from the peel/skin and seeds. The peel and seeds were discarded. The pulp was blended together using a blender. As for the vine tomato, roma variety of tomatoes were harvested from the same farm. The whole fruits were milled in a blender and used for development of paste.

Development of paste

The pulp from snake tomato and vine tomato were concentrated separately in a steam jacketed open kettle at 70^{o}C until moisture content was reduced to 40% and poured into already sterilized glass jars and closed tightly. The samples were pasteurized at 100^{o}C for 10 minutes by placing filled bottles in boiling water. The samples were then allowed to cool at room temperature and kept for further analysis

Chemical analysis

The beta-carotene and lycopene content were determined according to the method of Rodriguez-Amaya and Kimura (2004). Ascorbic acid, otherwise known as vitamin C content was analyzed following the method of Pongracz et al., (1971) while mineral composition was done using the method of Negi et al., (2012) with the aid of an atomic absorption spectrophotometer (Buck Scientific 2011)

Results and Discussion

The results of the vitamin C, β-carotene and lycopene content are displayed in figure 1. Snake gourd tomato had a significantly ($p<0.05$) higher content compared to vine tomato. The vitamin C value of snake tomato reported here is similar to the 0.25-0.24mg/g reported by Adebooye (2008) when he examined the two morphological types of snake tomato. However, the lycopene

content of the snake tomato in the present study is higher than that reported by the same study done by Adebooye. While he reported a lycopene content of 0.16-0.18mg/g, the present study recorded a value of 1.34mg/g. This discrepancy can be attributed to the differences in treatment given to pulp. While Adebooye examined the fresh pulp, the present study examined the paste developed from pulp after concentration. An earlier study (Mohammed and Malami 2013) has shown that heat treat releases lycopene from its matrix.

Vitamin C and lycopene are powerful antioxidants; lycopene gives tomato and other fruits like watermelon its characteristic red colour. It is a type of carotenoid. Antioxidants neutralize free radicals, which may damage the body cells. The radical scavenging activity of lycopene has been shown to be twice that of beta carotene (Weisburger, 2002).

Iron, calcium and potassium were significantly higher in snake gourd tomato compared to vine tomato while the reverse was the case for sodium (Table 1). Minerals are micronutrients needed in minute quantities but are essential for maintenance of good health. The content of minerals found in snake tomato is higher than that of vine tomato, therefore, it can support health and help in the prevention of diseases. The lower sodium content is beneficial in hypertensive conditions.

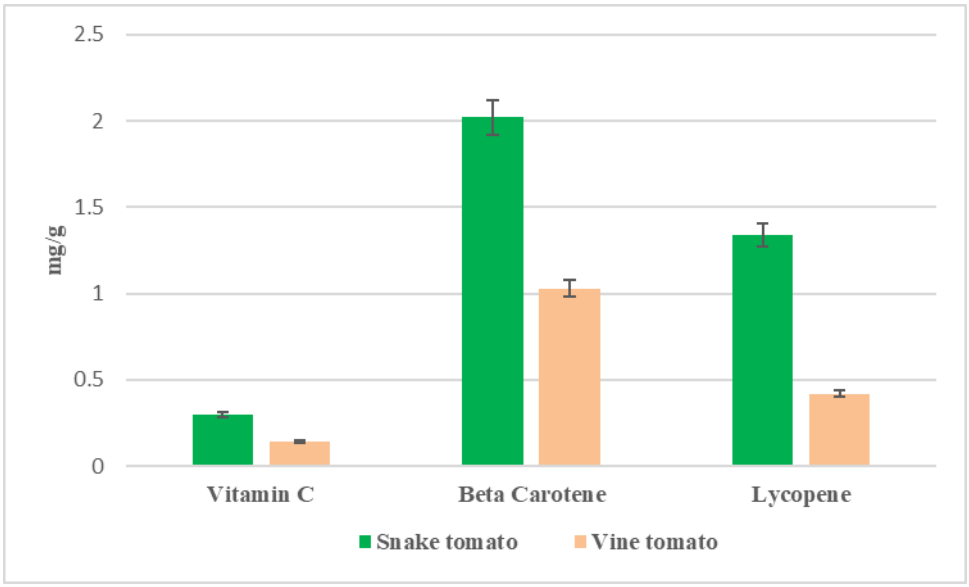

Fig 1: Vitamin C, Beta-carotene and Lycopene content of snake and vine tomato

Table 1: Mineral content of snake and vine tomato

Mineral content (mg/100g)	**Fe**	**Zn**	**Ca**	**K**	**Na**
Snake tomato	3.44*	0.86	13.38*	320.25*	59.2*
Vine tomato	2.69	0.24	12.01	179.6	6.35

Conclusions and Outlook

Paste from snake tomato had significantly ($P<0.05$) higher content of β-carotene, vitamin C, lycopene and minerals than paste from vine tomato, except for sodium. These essential nutrients contained in snake tomato make the fruit and its paste of nutritional and health importance. Thus, it can serve as a good substitute or complementary raw material for tomato paste industry.

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References

1. ADEBOOYE, O.C., OGBE, F.M.D. AND BAMIDELE J.F. (2001). Ethnobotanical Studies and Utilization of the Indigenous Leaf Vegetables of Southwest Nigeria. Technical Report. 64 p. Accra, Ghana: United Nations University/Institute for Natural Resources in Africa
2. CHUKU, E.C.**,** OGBONNA, D.N.**,** ONUEGBU, B.A. AND ADELEKE, M.T.V**.** (2008). Comparative Studies on the Fungi and Bio-Chemical Characteristics of Snake Gourd (*Trichosanthes curcumerina* Linn) and Tomato (*Lycopersicon esculentus* Mill) in Rivers State, Nigeria. Volume 8 (1): 168-172.
3. MBHENYANE, X.G. (2017). Indigenous Foods and Their Contribution to Nutrient Requirements. South African Journal of Clinical Nutrition; 30(4):5-7.
4. LIYANAGE R., NADEESHANI H., JAYATHILAKE C., VISVANATHAN R., AND WIMALASIRI S. (2016). Comparative Analysis of Nutritional and Bioactive Properties of Aerial Parts of Snake Gourd (Trichosanthes cucumerina Linn.) International Journal of Food Science. http://dx.doi.org/10.1155/2016/8501637.
5. MOHAMMED M.I. AND MALAMI D.I. (2013). Effect of Heat Treatment on the Lycopene Content of Tomato Puree. Chem Search Journal 4(1): 18–21
6. NEGI, S., BISHT, V. K., BHANDARI, A. K, AND. SUNDRIYAL R.C. (2012). Determination of mineral contents of *Digitalis purpure*a L. and *Digitalis lanata* Ehrh, Journal of Soil Science and Plant Nutrition, 12 (3):463–469.
7. Onagoruwa, O.O. (2002). Diversity and nutrient composition of Trichosanthes cucumerinaL. Unpublished B.Sc. (Agriculture) Thesis. Obafemi Awolowo University, Ile-Ife, Nigeria. pp 1-19.
8. PONGRACZ, G., WEISER, H. AND MATZINGER, D. (1971). Tocopherols – Antioxidants in nature. Fat Sci. Technol., 97, 90–104.
9. RODRIGUEZ-AMAYA, D.B, AND KIMURA, M. (2004). HarvestPlus Handbook for Carotenoid Analysis. Harvest Plus Technical Monograph. Series 2 Washington D.C. and Cali, Columbia. P.3
10. SANDHYA, S., VINOD, K.R., SEKHAR J.C., ARADHANA R. AND NATH, V.S. (2010). An updated review on *tricosanthes cucumerina* l., International Journal of Pharmaceutical Sciences Review and Research, 1(2):2*56-60.*
11. WEISBURGER, J.H. (2002), Lycopene and tomato products in health promotion. Experimental Biology and Medicine, 227, 924-927.