Evaluation of selected phytochemical content of freshly harvested tomato and tomato-based products

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ABSTRACT

The health benefits of tomato have make tomato and its derived products a perfect alternative choice as functional food. The study was carried out to evaluation selected phytochemical contents of freshly harvested tomato and tomato-based products. Freshly harvested tomato and four tomato-based products were analyzed using standard methods. Data were analyzed using computer software for one-way analysis of variance, while Duncan multiple range test (DMRT) was used to separate means where there is a significant difference. Range of values obtained for phenol, flavonoid, lycopene, and titrable acidity of the samples were 354.42 to 2047.29 mg/kg, 315.98 – 1452.30 mg/kg, 212.18 to 500.79 mg/kg, and 15.93 – 53.19ml/kg. The results showed that tomato-based commercial products are indeed richer in selected phytochemical investigated than freshly harvested tomato.

Keywords: Flavonoid, functional food, lycopene, phytochemical, tomato-based products

INTRODUCTION

Tomato is a small and versatile food classified as fruit or vegetable depends on its usage either for culinary or processing purpose. In tomato; only its fruit can be eaten since the leaves contain toxic alkaloids. The cultivated tomato, *Solanum lycoperison*, is the second most consumed vegetables worldwide and a well-studied crop spices in terms of genetics, genomics, and breeding (Bruhn *et al*., 1991). The fruits are usually red or yellow in colour due to the presence of lycopene and carotenes. The reason for tomato's popularity is because of its various nutrient values; its supplies vitamins especially beta carotene, vitamin C, variety of colour, and flavour to the world diets and Nigerians inclusive (Sahidi *et al*., 2011). Apart from that, tomato fruits supplies minerals such as iron, calcium, it also containing antioxidants known as phytochemical which chemical compounds that occur naturally in the plants (Mes *et al*., 2008; Sahidi *et al*., 2011).

Phytochemicals are non-nutritive plant chemicals that have protective and curative effect on human diseases. There are more than thousand known phytochemical. It is well known that plant produce these chemicals to protect itself but recent research demonstrate that they can protect humans against diseases (Goldman, 2011). Consumers are gradually aware of functional and healthy characteristics of agricultural food products including tomato and its products. Although it is not clear whether marketing or for health functionality is spurring this interest, or vice versa, there is an increasing attention in the development of new phytochemical-rich vegetable varieties via breeding programs (Cappellano *et al*., 2009;

Goldman, 2011). It is a well-known fact that fruits and vegetables are an important source for the daily intake of healthy constituents to the diet like minerals (calcium, phosphorous, magnesium and other minor minerals), water-soluble vitamins (B and C), fat-soluble vitamins (A, E and K) and a wide variety of phytochemical (Sahidi *et al*., 2011). Among phytochemical, we can find bioactive molecules capable to protect against diseases acting as free radical scavengers or antimicrobial agents.

The most renowned phytochemicals from vegetables are polyphenols, carotenoids, organo-sulfur and seleno-compounds. Their presence in certain plants would, in part, justify the epidemiologic evidence of a protective role of diets rich in fruits, vegetables, legumes and whole grains (Kris-Etherton *et al*., 2002). Although, it is necessary to continue on research of the effects of phytochemicals on health to understand the mechanism of action and the associations of these molecules in cancer-risk prevention, the development of long-term breeding programs should be started to promote the benefits of vegetable consumption (Rau *et al*., 2016). The high level of consumption and the high economic value of tomato production has spurred the scientific and breeding efforts in this species, and position tomato as one of the main sources of chemoprotective compounds to diet (Chun *et al*., 2005), including vitamin C. Apart from their antioxidant capacity, other mechanisms contribute to cancer prevention, including immune modulation, hormone and growth factor signaling, regulatory mechanisms of cell cycle progression, cell differentiation and apoptosis (Takana *et al*., 2012).

According to Dewanto et al. (2002), thermal processing such as pasteurization and sterilization is widely used for shelf-life prolongation of food products. On the other hand, this process is not able to preserve their natural colour, flavour and nutrients. The nutritional value of tomatoes may be increased after thermal processing, as described by Dewanto et al., 2002). Their results pointed out that lycopene concentration is increased as it may be released from its natural matrix during the heat process. Dewanto et al. (2002) also evaluated phenolic and total flavonoid content of heat-processed tomatoes, revealing non-significant changes in their content after the thermal process. Other authors have found a reduction of polyphenol content as a consequence of cooking. In this sense, Crozier et al. (1997) showed an 82% of loss of quercetin content if tomatoes are boiled, a 65% loss if they are microwaved and 35% if they are fried.

On the other hand, carotenoid concentration remains constant if tomatoes are boiled or even it can be more concentrated in tomato paste (Khachik *et al*., 1992). Thus, non-thermal technology such as high pressure processing is preferred to maintain the sensory attributes and nutritional value of products (Dewanto *et al*., 2002). On the other hand, processed foods have been long considered to have lower nutritional value than their fresh commodities due to the loss of vitamin C during processing. Thermal processing elevated total anti-oxidant activity and bio-accessible lycopene content in tomato and produces no significant changes in the total phenolics and total flavanoids content although loss of vitamin was observed. The results on the retention of polyphenols in tomato processed products are variable. Muir et al. (2001) found that 65% of flavonols present in high-flavonol tomatoes were retained in processed tomato paste, while Stewart et al. (2000) found that tomato flavonols like quercetin, can resist common processing methods and therefore they can be found in tomato-derived products such as tomato juice or tomato puree which are particularly rich these compounds. Obviating the relative differences in these studies, it seems clear that health benefits of processed tomato products may be similar or even higher than raw tomatoes, and make tomato-derived products a perfect alternative choice as functional food (Raul *et al*., 2016). The study therefore, aimed to evaluate selected phytochemical in freshly harvested tomato and tomato-based products commonly vendor in Nigeria market.

MATERIALS AND METHODS

Freshly harvested ripe tomatoes were obtained from a local farm at Awe, Oyo State, Nigeria, while selected tomato based products: Gino, Ric-Giko, Sonia, Vitali that had same expiration date were purchased at a popular local market in Oyo town, Oyo State, Nigeria.

SAMPLE PREPARATION

The tomatoes were washed with clean water to reduce microbial load and remove adherent contaminants. The outer skin of the tomatoes using stainless steel knife were peeled, deseeded, and homogenized using the kitchen wonder blender. The fresh tomato paste serve as control. The fresh tomato paste obtained were aseptically filled into sterilized polyethene nylon and kept at -4^{o}C until needed for analysis.

CHEMICAL ANALYSIS OF SAMPLES

Lycopene determination was carried out using the method of Qin *et al*. (2011), while total flavanoids was determined using the method described by AOAC (2005). Total phenol, titratable acidity (TTA), and total carotene and alkanoids were also determined by the method described by Pearson (1991).

RESULTS AND DISCUSSIONS

PARAMETERS	A	B	C	D	E
Phenols mg/kg	354.42±2.13^{a}	2047.29±5.03^{e}	441.58±2.18^{b}	897.85±1.69^{d}	677.56±3.02^{c}
Flavanoids mg/kg	315.98±1.82^{a}	1452.30±6.17^{d}	564.93±0.83^{b}	711.44±2.23^{c}	617.67±4.18^{b}
Carotene g/kg	1.97±0.01^{a}	32.15±0.61^{d}	12.33±0.29^{b}	14.02±0.72^{c}	12.40±0.13^{b}
Lycopene mg/kg	401.64±1.74^{c}	431.63±2.14^{d}	212.18±1.89^{a}	243.08±1.95^{b}	500.79±3.21^{e}
Alkaloids %	2.31±0.11^{a}	3.38±0.01^{a}	10.56±0.13^{c}	2.60±0.00^{a}	4.45±0.36^{b}
TTA g/kg	17.72±0.16^{b}	53.19±0.49^{e}	15.93±1.01^{a}	34.83±0.53^{d}	26.09±0.88^{b}

Sample A= Control); Sample B= Gino; Sample C=Ric-Giko; Sample D= Sonia; Sample E= Vitali

DISCUSSION

There are significant differences ($p<0.05$) in samples phytochemical compositions. For phenol, the mean result shows the mean value range (354.42 – 2047.29mg/kg) with sample B having the value of (2047.29mg/kg) which has the highest value followed by sample D which has the value (897.85mg/kg) while the least value goes to sample A which has the value (354.42mg/kg) while sample C and E have the value (441.58mg/kg) and (677.56mg/kg) respectively. From the result, it could be deduced that there is a significant difference between sample A, B, C, D, E. Sample B has more phenol content than other processed and unprocessed samples. This result agreed with the work of Colliver et al., 2000 and Slimestad et al., (2008). The mean result for flavanoids shows that the value ranges from (315.98 – 1452.30mg/kg), with sample B having the highest value, followed by sample D, followed by sample E and then sample C, while sample A has the lowest value of (315.98mg/kg). This shows that there is significant difference among the samples. The result showed that flavonoid content in different tomato products and fresh tomatoes; it can be adjudged that sample B is indeed richer in flavanoids than other tomato samples observed. This is similar to the work of Martinez-Valverde *et al*. (2002) who investigated lycopene and antioxidant activity in commercial varieties of tomato.

The mean result for carotene which is responsible for colour in samples show the value ranges from (1.97 – 32.15g/kg) with sample B having the highest value of (32.15g/kg) followed by other samples, while sample A has the lowest value of (1.97g/kg). the result showed that other samples which have been processed are more enriched in carotene than sample which is fresh and unprocessed. The result agreed with the work of Dewanto *et al*. (2002).The mean result for lycopene ranged from 212.18 to 500.79 mg/kg with sample B having the highest value of 500.79 mg/kg followed by sample B, A and D, while the lowest value goes to sample C with value of (212.18mg/kg). Sample E is richer in lycopene than other tomato products and freshly harvested tomato. The mean result from the table for alkaloids shows that the value ranges from (2.31 – 10.56%) with sample C having the highest value of (10.56%) followed by sample E and B while there is a very little difference between sample D and A. Nevertheless, the lowest value goes to sample A with the value of (2.31). The mean result of the titratable acidity (TTA) shows the value range is between (15.93 – 53.19g/mg) with sample B having the highest value of (53.19g/mg) followed by samples D, E and A while the least value goes to sample C with value of (15.93g/mg).

CONCLUSION

Tomato based products obtained from market significantly have more phytochemical than freshly tomato. The lycopene content of freshly harvested tomato was more than some of the tomato-based products obtained from market. The study showed that commercial based tomato products are richer in phytochemical contents than freshly harvested tomato. However, the bioavailability of freshly and commercial based tomato need to be determined in-vitro to know which one would be more preferable for man consumption..

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