

# Estimation of lycopene content in different tomato varieties and its commercial products

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**SUMMARY :** Lycopene, the predominant carotenoid in tomatoes, exhibits the highest antioxidant activity and singlet oxygen quenching ability of all dietary carotenoids. The present study evaluated the lycopene content of fresh tomatoes, temperature treated and commercial products (sauce, ketchup and puree) procured from Thiruvananthapuram city, Kerala. The raw tomatoes showed the highest lycopene content (*Bella rosa* 10.44 mg/kg fresh wt) and commercial products showed least values (sauce 0.137 mg/kg fresh wt and ketchup 1.23 mg/kg fresh wt). This study recommends the usage of a tomato product daily to reduce the rate of chronic diseases.

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Key Words :

Tomato, Lycopene, Vitamin, Carotenoid, Antioxidant activity

The word “tomato” refers to the plant for the edible, typically red fruits that it bears. This domesticated fruit was first introduced into Europe in 1554 after the Spanish colonization of the Americas (Gould, 1992). It is used in diverse ways, including raw in salads and processed into ketchup or tomato soup. Tomatoes are acidic, thereby making them easy to preserve in home canning whole, in pieces, as tomato sauce or paste. Tomatoes are now eaten freely throughout the world, and their consumption is believed to benefit the heart, among other organs. Tomatoes have been traditionally credited as rich sources of carotenoids and vitamins, particularly beta-carotene, pro-vitamin A, ascorbic acid, and vitamin (Hanson *et al.*, 2004). In recent years, another important carotenoid in tomatoes, lycopene, has received considerable attention. Lycopene is responsible for the red color in tomatoes, watermelons, and pink grapefruits (Rao and Agarwai, 2000).

Lycopene (from the new Latin word *lycopersicum*, referring to the tomato species) is a bright red carotene and carotenoid pigment and photochemical found in tomatoes and other red fruits and vegetables, such as red carrots, red bell

peppers, watermelons, gac and papayas (but not strawberries or cherries). Although lycopene is chemically a carotene, it has no vitamin A activity. Lycopene is a bioactive carotenoid present in many fruits and vegetables. Tomatoes constitute the major dietary source of lycopene. Recent evidence shows lycopene to be associated with several health benefits. However, very little information is available about the stability of lycopene and its bioavailability. Because tomatoes undergo extensive processing and storage before consumption, recent studies (Delgado-Vargas and Paredes-Lopez, 2003) evaluated the stability, isomeric form, bioavailability, and *in vivo* antioxidant properties of lycopene. Total lycopene and isomers were measured by spectrophotometry and high-performance liquid chromatography, respectively. The antioxidant capability of lycopene has led to promising results in decreasing the risk of some illnesses and cancers. Several studies showed that lycopene is able to prevent the oxidation of low-density lipoprotein (LDL), which causes the atherogenic process and heart disease (Delgado-Vargas and Paredes-Lopez, 2003).

In fresh tomatoes, the content of lycopene

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was reported to range from 2.5 to 200 mg/100 g of raw tomato (Takeoka *et al.*, 2001; Dewanto *et al.*, 2002; Seybold *et al.*, 2004). The level of lycopene is directly related to ripeness and increased pH (Thompson *et al.*, 2000). Thus, these factors may explain the wide variability of reported lycopene content in raw tomato. Also, changes of lycopene content in tomato during storage, semi-drying, and paste or juice processing have been reported (Anguelova and Warthesen, 2000; Takeoka *et al.*, 2001; Dewanto *et al.*, 2002; Seybold *et al.*, 2004; Goula *et al.*, 2006 and Toor and Savage, 2006).

## EXPERIMENTAL METHODOLOGY

Different varieties of tomato sample were collected for the estimation of lycopene content present in tomatoes during 2012-2013 in Thiruvananthapuram city. The varieties of tomatoes used in this study which were available throughout the year include *Coeur de pigeon rouge*, *Bella rosa*, *De berao*, *Auriga*, cherry tomatoes, orange banana tomatoes, *Yellow Beijing*, *Jaune flame* and *Macumba*. The fresh tomatoes along with boiled and smashed ones were used for the experiments. Commercially available tomato products such as tomato puree, sauce and ketchup were also used in this study.

Well homogenized tomato paste is obtained without air bubbles, prepared under vacuum. 100 $\mu$ L of sample was taken into a screw capped tube, care being taken to avoid air bubbles. Also prepared several blank samples with 100 mL water instead of tomato pulp. Added 8.0 ml of hexane: ethanol: acetone (2:1:1) mixture. Capped and vortex the tube immediately, incubated out of bright light for 10 minutes, added 1.0 ml water to each sample and vortex again. Kept for 10 minutes to allow phases to separate and all air bubbles to disappear. Determined the absorbance of the upper layers of lycopene samples at 503 nm.

Lycopene levels in the hexane extracts were calculated using the formula:

$$\text{Lycopene (mg/kg fresh wt.)} = (A_{503} \times 537 \times 8 \times 0.55) / (0.10 \times 172)$$

where, 537 g/mole is the molecular weight of lycopene, 8 mL is the volume of mixed solvent, 0.55 is the volume ratio of the upper layer to the mixed solvents, 0.10 g is the weight of tomato added, and 172 m M<sup>-1</sup> is the extinction co-efficient for lycopene in hexane.

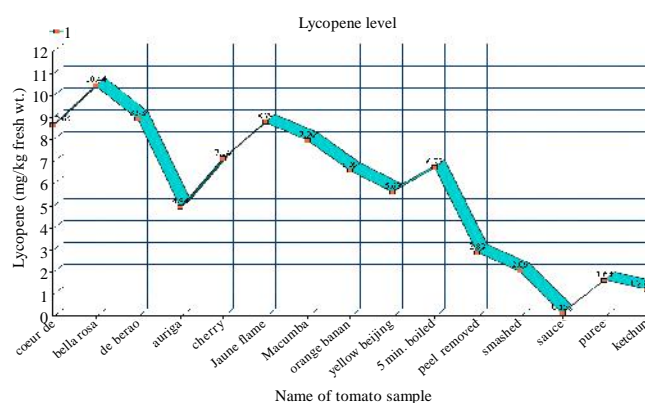
## EXPERIMENTAL FINDINGS AND DISCUSSION

Table 1 shows the lycopene level (mg/kg fresh wt.) in tomatoes and their commercial products were studied. The concentration of lycopene in different samples is given in Table 1 and in Fig. 1.

The lycopene content of tomatoes and different tomato products were determined in this study. Different tomato varieties such as *Coeur de pigeon*, *Bella rosa*, *Deberao*,

**Table 1 : Concentration of lycopene**

Sr. No.	Samples	Average reading at 503 nm	Lycopene (mg/kg fresh wt.)
w	Coeur de pigeon rouge	0.063	8.65
2.	Bella rosa	0.076	10.44
3.	De berao	0.065	8.92
4.	Auriga	0.036	4.94
5.	Cherry tomato	0.052	7.14
6.	Jaune flame	0.064	8.79
7.	Macumba	0.058	7.96
8.	Orange banana tomato	0.048	6.59
9.	Yellow beijing	0.041	5.63
10.	5 minute boiled	0.049	6.73
11.	Peel removed tomatoes (through boiling)	0.021	2.88
12.	Smashed tomatoes	0.015	2.06
13.	Sauce	0.001	0.137
14.	Tomato puree	0.012	1.64
15.	Tomato ketchup	0.009	1.23



**Fig. 1 : Lycopene level**

*Auriga*, cherry tomatoes, *Jaune flame*, *Macumba*, Orange banana, yellow Beijing varieties were taken for the study as raw. Among these samples, *bella rosa* showed large amount of lycopene (10.44 mg/kg fresh wt.) content. De berao (8.92 mg/kg fresh wt.), *Jaune flame* (8.79 mg/kg fresh wt.), *Coeur de pigeon rouge* (8.65 mg/kg fresh wt.). These three varieties showed only slight difference in the lycopene level. The *Auriga* tomatoes showed least amount (4.94 mg/kg fresh wt.) lycopene. The smallest varieties of tomato were cherry tomatoes and these showed the lycopene level 7.14 mg/kg fresh wt. The cherry tomatoes showed more lycopene content than *Auriga* (4.94 mg/kg fresh wt.). Orange banana tomato showed 6.59 (mg/kg fresh wt.) lycopene. Yellow Beijing showed 5.63 mg/kg fresh wt. lycopene content. The temperature exposed tomatoes showed low amount of lycopene content. Smashed tomatoes showed only 2.06 mg/kg fresh wt. lycopene and peel removed (through boiling) tomato sample showed

2.88 mg/kg fresh wt. lycopene. Five minute boiled tomatoes showed more lycopene content than these two heat treated tomato samples (*i.e.*, 6.73 mg/kg fresh wt.).

Commercial products of the tomatoes such as sauce, puree, ketchup were used. Among these the sauce showed least amount of lycopene (0.137 mg/kg fresh wt.) followed by the tomato ketchup as 1.23 mg/kg fresh wt. and tomato puree contained 1.64 mg/kg fresh wt of lycopene. The raw tomatoes contained more lycopene content than the processed tomato products. The study conducted showed that the *Bella rosa* contained higher amount of lycopene than all the commercial products. The sauce used in this study contained very least amount of lycopene content.

### Conclusion :

Tomatoes, eaten freely throughout the world contains the carotene lycopene, one of the most powerful natural antioxidant. The antioxidant capability of lycopene has led to promising result in decreasing the risk of some illness especially related to heart ailments and cancers. A decrease has been observed in lycopene content during processing and the raw tomato materials showed high values of lycopene content (*Bella rosa*-10.44 mg/kg fresh wt.), least values found in the sauce materials as 0.137 mg/kg fresh wt and ketchup as 1.23 mg/kg fresh wt). The changes of lycopene content in tomatoes during heat treatment was found to be less from this study and temperature may be one reason for this variation in the lycopene content. Eating a single serving of tomatoes increases the lycopene level in the blood streams. Eating regular supply of tomato produced has been linked with a reduced rate of chronic disease.

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