

Nutritional Content and Significance of Tomato Powder

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Abstract: Tomatoes are known to be a rich source of vitamins, minerals and carotenoids, especially vitamin-C, phosphorus, potassium, and lycopene and it may become an ideal addition to different types of processed foods. Keeping in view all these facts, dried tomato powder was prepared and analyzed for its vitamin-C, lycopene and mineral contents. Tomato powder contain vitamin-C 125 mg, lycopene 1.41 mg, iron 3.99 mg, phosphorous 173 mg, calcium 80 mg, magnesium 126 mg, Zinc 2.71 mg, copper 0.876 mg, manganese 1.83 mg, sodium 121.60 and potassium 2805.8 mg per 100 g. The results obtained showed that it is a good source of various macro and micro mineral elements. One hundred grams of tomato powder provides between 5.81-74.82% and 6.39-87.00% of the daily recommended intake for different macro and micro mineral elements for Indian male and female, respectively.

Key words: Mineral, trace element, lycopene, daily Recommended Intake.

The role of plants in maintaining human health is well documented (Moerman, 1996). Fruits and vegetables possess protective effect against various degenerative diseases due to the presence of various phytochemicals, carotenoids, vitamins and minerals. Several research reports are available in recent years on the biological functions of microelements in human body. Therefore, in recent years, there has been an increasing interest in the use of these elements as micro-nutrient supplements or functional foods in medical treatment to prevent various diseases such as cancer, cardiovascular diseases, AIDS, Alzheimer's disease, osteoporosis, osteoarthritis, asthma, cataract, and ageing (Hunt, 1996; Reilly, 1998; Rayman, 2000). Tomato is important vegetable crop grown worldwide. When there is seasonal glut farmer doesn't fetch good price moreover a big share of crop produce is spoiled and become a waste due to lack of proper processing and storage. However, it can be processed to value added products. Fruit and vegetable powders obtained by drying to a certain moisture level are an ideal addition to soups, sauces, marinades, baby foods, dips, extruded cereal products, fruit purees, and fillings for frozen toaster snacks (Francis and Phelps, 2003; Pszczola, 2003) owing to their

characteristic color, flavor and water binding properties. However, drying had been used commercially to prepare fruit powders, but many of the important nutrients are degraded during thermal processing of food (Goula et al., 2006; Goula and Adampoulos, 2005).

To better determine the role of tomato powder in different food applications, additional information on quality characteristics and nutrient composition especially vitamin C, lycopene content and minerals are required, which have not been explored much. In view of this quality characteristics, vitamin C, lycopene and mineral contents of tomato powder were determined.

Materials and Methods

Fresh tomatoes (*Lycopersicon esculentum* of var. 'Himsona' [Syngenta AG]) of 4-5 cm in length were selected for study. Tomato pulp was dried at 50, 60 and 70°C at 53% RH for 8, 10 and 12 h in industrial type tray dryer to prepare powder. Tomato powders were analyzed for their physical characteristics i.e. color, water absorption capacity and particle size distribution (Srivastava and Kulshreshtha, 2012). Tomato powder was prepared in bulk and packets of 100 g were prepared and was filled in sealed aluminum foil sachets and then packaged in the high-density polythene bags (thickness 80 microns) by double sealing and stored at -18°C in deep freezer. Tomato

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powder prepared at 60°C, based on physical quality attributes, was found to be optimum and selected for the further analysis.

The sensory evaluation was performed by a trained/semi-trained panel members. A 5-point hedonic scale ranging from 1 = dislike it very much to 5 = like it very much was used to evaluate acceptance of the TP-1, TP-2 and TP-3 samples dried at 50, 60 and 70°C, respectively. The measured attributes were color, appearance taste/ flavor, texture and overall acceptability (Meilgaard et al., 1991). Data were subjected to analysis of variance.

Moisture and ash content was determined using AOAC (1975) method. Vitamin C content was estimated by the xylene extraction method of Robinson and Stotz (1945). Lycopene content was estimated by the procedure given by Beerh and Sidappa (1959), as quoted in the Ranganna (1986). Phosphorus in the sample was estimated by the procedure of Fiske and Subba Row as quoted by Ranganna (1986). Calcium content was determined by titrimetric method of AOAC (1975). Magnesium was estimated by the gravimetric method as quoted by Raghuramulu et al. (2003). Iron, manganese, copper, zinc, sodium and potassium levels were estimated by atomic absorption spectrophotometer (AAS) as described by Raghuramulu et al. (2003). In case of higher concentrations of mineral element, original samples were diluted in order to achieve the optimum working conditions for the instrument.

Results and Discussion

Sensory evaluation was performed to assess the sensory attributes of the product and its acceptability (Fig. 1). There was significant

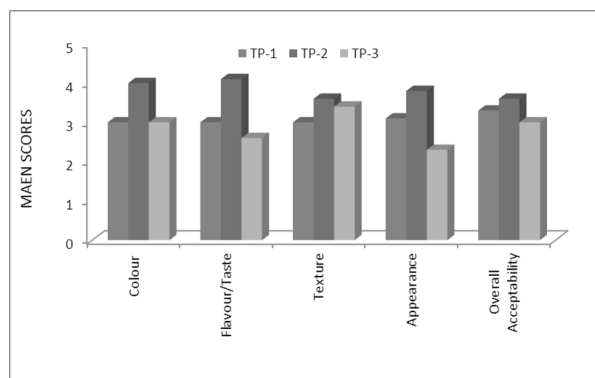


Fig. 1. Mean scores of sensory characteristics in tomato powder prepared at 50, 60 and 70°C.

difference between the mean scores obtained for appearance and taste in TP-1 and TP-3. In case of appearance and taste, which are very important attributes of any food product, lowest scores were obtained by TP-3. When mean scores of TP-1 and TP-2 were compared significant difference between the scores was found for color and taste. Highest score for color, flavor, appearance and overall acceptability was obtained by TP-2. Hence, the tomato powder prepared at 60°C was found best on the basis of sensory attributes.

Based on physical quality and sensory attributes tomato powder dried at 60°C was found optimum. It was analyzed further for ascorbic acid, lycopene and mineral contents. Moisture and ash contents were found to be 5.6 and 7.3%, respectively. The moisture content of tomato powder corresponds with the values reported by other studies Gupta et al. (2006) and De Souza et al. (2008) which were 5.2 and 4-6.8%, respectively. However, the moisture content of tomato powder was slightly higher than the values given by USDA. The mean ash content was 7.3%, which was lower than the values reported by USDA (Table 1). The mean value of vitamin C content in tomato powder was 125 mg per 100 g, which was higher than reported by USDA. Muratore et al. (2008) also reported 112.7 g per 100 g vitamin C in partially dehydrated cherry tomatoes *Lycopersicon esculentum* var. 'Shiren'. The vitamin C content of food product reduces during processing and thermal treatments.

Table 1. Chemical composition of tomato powder

Mineral	Tomato powder (mg/100 g)	USDA values* (mg/100 g)
Moisture (%)	5.60	3.9
Ash (%)	7.3	8.91
Vitamin C	125.00	116
Lycopene	1.41	-
Iron	3.99 ± 0.32	4.56
Calcium	80.0 ± 1.00	166
Phosphorus	173 ± 2.08	295
Magnesium	126 ± 0.15	178
Copper	0.876 ± 0.80	1.24
Zinc	2.71 ± 0.05	1.71
Manganese	1.83 ± 0.53	1.95
Sodium	121.60 ± 1.49	134.00
Potassium	2805.8 ± 21.41	1927.00

*Source: <http://ndb.nal.usda.gov/ndb/search/list>

Table 2. Per cent of recommended dietary allowance of different minerals provided by tomato powder

Mineral Element	RDA (Indian male*) (mg d ⁻¹)	RDA provided by Tomato powder for Indian Male (%)	RDA (Indian Female*) (mg d ⁻¹)	RDA provided by Tomato powder for Indian Female (%)
Iron	17.00	23.40	21.00	19.00
Calcium	600.00	13.33	600.00	13.33
Phosphorus	600.00	28.83	600.00	28.83
Magnesium	340.00	37.05	310.00	40.64
Copper	1.35	64.80	1.35	64.80
Zinc	12.00	22.58	10.00	27.10
Manganese	2.00	91.50	2.00	91.50
Sodium	2092.00	5.81	1902.00	6.39
Potassium	3750.00	74.82	3225.00	87.00

*Source: http://www.pfndai.com/Draft_RDA-2010.pdf

Loss of vitamin C is accelerated by water loss (Barth and Zhuang, 1996) and its relative stability or degradation is highly dependent on temperature and commodity type (Klein, 1987). However, cooking losses are greatest for thiamine and vitamin C because these vitamins are most thermo sensitive. Destruction of these two labile vitamins is considerably less in the acid medium provided by tomatoes (Klein, 1987).

Lycopene content was 1.41 mg per 100 g in tomato powder. Retention of total lycopene content in tomato powder was 52% compared with fresh tomato. Heat processing and storage of tomato products causes lycopene degradation to certain extent as reviewed by Nguyen and Schwartz (1999).

Mineral content of tomato powder vary according to variety, growing conditions, level of maturity at harvesting, soluble solids concentration, processing conditions, and drying technique used (Harold et al., 2007). Tomato powder prepared in this study contained per 100 g iron 3.99 mg, 173 mg phosphorus, 80 mg calcium, 126 mg magnesium, 2.71 mg Zinc, 0.876 mg copper, 1.83 mg manganese, 121.60 mg sodium and 2805.8 mg potassium. (Table 1). The levels of all the minerals except zinc and potassium were found to be lower than those reported by USDA. The nutritional significance of tomato powder may be attributed to the good amount of various minerals it possesses. One hundred grams of tomato powder provides between 5.81 to 74.82% and 6.39 to 87.00% of the Daily Recommended Intake for different macro and micro mineral elements for Indian male and female, respectively (Table 2). It is also clear from the table that tomato powder

is a rich source of potassium > manganese > copper > magnesium > phosphorus and zinc. Interestingly it also provides almost 25 % of the RDA of iron for males while 19 % for females.

Nutritional significance of tomato powder can be accorded keeping in view the fulfilment of large share of daily recommended intake of vitamins and minerals for Indian population. Tomato powder was found rich in vitamin C content i.e. 125 mg per 100 g which indicates that consumption of 32 g of tomato powder can meet the RDA of ascorbic acid successfully. One hundred grams of tomato powder provides between 5.81 to 74.82% and 6.39 to 87.00% of the Daily Recommended Intake for different macro and micro mineral elements for reference Indian male and female, respectively. It is also clear from the table that tomato powder is a rich source of potassium, manganese, copper, magnesium, phosphorus and zinc. Interestingly it also provides almost 23% of the RDA of iron for males while 19% for females.

Data obtained indicated that tomato powder possess high nutritional potential, and its mineral content per 100 g was quite good to meet RDA of vitamin C and various minerals. It also provides 1.41 mg of lycopene, which is potent antioxidant. Moreover, being in powdered form, further increases its shelf stability and applicability, hence can be effectively used in different food products, mineral mixtures, supplements and anti-aging products.

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