Nutritional evaluation of tomato powder.

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Abstract

An Investigation was undertaken to study physical parameters of two varieties of tomato (Angoorlata and Azad T6) and nutritional evaluation of tomato powder. The physical parameters included in the study were, size, shape, colour, locule number, pericarp thickness, flesh, skin, seed, edible index and waste index. The physical parameters of two varieties differed significantly. In this study, tomato samples were blanched as a pre-treatment and after blanching tomato slices were subjected to two drying methods (sun and hot air oven). Nutritional content of tomato powder were analysed by using AOAC (2005) methods. Moisture content in tomato powder was comparatively higher in sun drying than hot air oven drying. Sun dried and hot air oven dried Angoorlata tomato powder contains 7.4% and 5.8% moisture respectively. Sun dried and hot air oven dried Azad T6 tomato powder contains 6.5% and 5.43% moisture respectively. Hence it was clear that moisture content in different varieties of tomato powder depended on drying methods. Lycopene content was significantly affected by drying method hot air oven dried Angoorlata tomato powder contain 1.74 mg/100 gm while sun drying contain 2.41 mg/100 gm. Lycopene content in sun dried and hot air oven dried Azad T6 tomato powder contain 2.17 mg/100 gm and 1.83 mg/100 gm respectively. It was clear that sun dried tomato powder had highest lycopene. Sensory evaluation revealed the overall acceptability of Angoorlata dried in hot air oven were found to be more than Azad T6 tomato powder dried in hot air oven.

Keywords: Angoorlata, Azad T6, Pre-treatment, Blanching, Edible index, Waste index.

Introductions

Fruits and vegetables are highly perishable and are usually available in plenty of a particular time of the year. (FAO 2012) Tomato is the edible fruit which belongs to the nightshade family, solanaceae. Tomato, (solanum lycopersicum) though botanically a fruit for the purpose of trade is generally considered a vegetable because of the way in which it is consumed [1]. Tomato is important vegetable crop grown worldwide. Tomatoes are produced and processed during two main seasons in India August to October (kharif) and December to April (rabi) [2]. Tomatoes are also grown during the off-season (May to July) where conditions suit and also under protected cultivation are grown in our country in abundance; the largest production centres are in southern and central India-principally the states of Andhra Pradesh, Telangana, Karnataka, Madhya Pradesh, Maharashtra and Uttar Pradesh. Today India is the second largest producer of tomatoes, producing nearly 12 million tonnes. For fiscal year 2020, the volume of tomato production in India amounted to over 21 million metric tons. Statista Post harvest losses of fruits and vegetables in India are reported to be 20% to 30% respectively. Drying of tomato helped to curb the huge post- harvest loss [3]. Presently in India only 2.2% of fruits and vegetables are processed. Indian production of processed food is comparatively low when compared to other developed countries. Narsing of Uttar Pradesh province shared an area of 0.08 million hectares with 3.28 million Metric tons production (Indian Horticulture database) [4,5]. Tomato ranks third in priority after potato and onion in India but ranks second after potato in the world. Tomato is grown throughout the world mainly in China, India, U.S.A, Italy, Turkey, Mexico, Russia, and Japan etc. On a global scale, the annual production of fresh tomatoes amounts to approximately 180 million tonnes. However, about a quarter of those 160 million tonnes are grown for the processing industry, which makes tomatoes the World's Leading Vegetable for Processing (WPTC) [6]. Tomato and tomato products are rich in health-related food components as they are good sources of carotenoids (in particular, lycopene), ascorbic acid, vitamin E, folate and total phenolic compounds. Dried tomato in the form of slices or powder helps to develop new food materials for ready to eat products [7].

Methods and Materials

For carrying out experiments, fully ripened tomato of Azad T6 and Angoorlata varieties were procured from the Department of Vegetable Science of CSA, University of Agriculture and Technology, Kanpur in the month of February. Tomatoes

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were weighed, washed thoroughly under running tap water to remove dirt and soil, and drain out excess water, sorted, then sliced to 5-7 mm thickness slices using knife prior to pre- treatment process. The slices were kept in a stainless steel sieve placed over a pan containing boiling water and blanched for 20 seconds. Blanching loosened the skin of tomato and easily removed. Then tomato slices were placed in hot air oven at the temperature 65ºC for 24 and for sun drying tomato slices were placed in steel tray and then exposed to the sun light Each observations were recorded in triplicates. The dried tomato slices were then powdered in a blender.

Hot air oven drying

Tomato of slices was dried from each variety (Angoorlata and Azad T6) of tomato. Slices were distributed uniformly in a thin layer onto the stainless steel trays of size 15 × 20 mm and dried in an oven (220/230 V. AC INCUBATOR) at temperature 65ºC for 24 hours.

Sun drying

Tomato slices were dried from each variety of tomato distributed uniformly as a thin layer onto the stainless steel trays of size 15 × 20 mm and dried under direct sunlight at temperatures between 26.30ºC and 32.65ºC for 6 days in February and March in Kanpur (UP) India. The moisture in the environment was 36% during the days in which the material were dried. Temperature and moisture in environment was observed by Weather forecast application.

Physical parameters of fresh tomato

Physical parameters of tomato varieties were observed through visual observation, suitable methods and formulae.

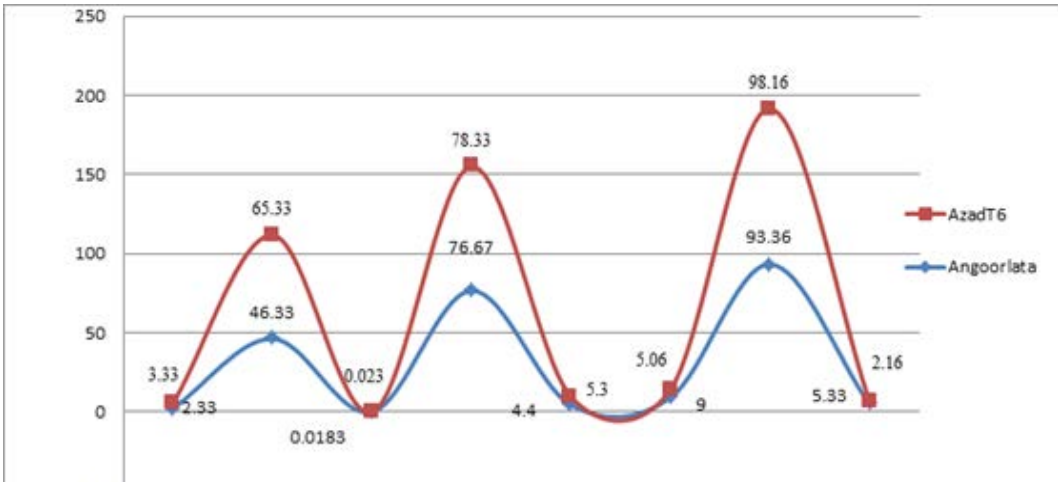
Estimation of nutritional content of prepared tomato powder

Nutritional content of the prepared dried tomato powder was estimated as per AOAC [8].

Results and Discussion

Visual observation of tomato varieties revealed variation in colour, size and shape. It was observed that Angoorlata was oval shaped and yellowish red in colour, whereas Azad T6 was spherical shaped and deep red in color similar result was observed by Aggarwal [9]. Angoorlata was smaller in size than Azad T6. Size of tomato varieties were determined by calculating diameter of fruits and found 4 × 5 diameter for Angoorlata fruits which is generally considered as small and 5 × 5 for Azad T6 which considered as medium size. Locule number in Angoorlata had 2 to 3 and 3 to 4 in Azad T6 tomato and there was positive correlation with size and locule numbers of tomato similar result was reported by Thakur and Lal Kaushal [10]. The fruit weight of the varieties ranged from 48 to 65 grams. The maximum weight of angoorlata had 48 gm while maximum weight of Azad T6 had 65 gm. Analysis of correlation showed the positive correlation between the varieties. Pericarp thickness was 0.018 in Angoorlata and 0.023 in Azad T6 tomato. Flesh content found to be more in Azad T6 than Angoorlata and flesh content of fruit was correlated with pericarp thickness and weight of tomato. Seed content was relatively higher in Angoorlata than Azad T6. Edible index was found to be more in Azad T6 than Angoorlata and there was positive correlation with edible index and the weight of tomato. Further the student's test revealed that fruit waste index of Angoorlata was significantly different from Azad T6 tomato (Figure 1 and Table 1).

We observed from the above table that tomato varieties dried in hot air oven had red coloured powder while tomato varieties which were dried in direct sun light had brown or dark brown colour. Sun dried samples were slight burnt odour and were discoloured as sunlight was not uniform throughout drying. Weight of final product of Azad T6 tomato had more than that of Angoorlata tomato from both sun and hot air oven drying methods. Colour of tomato variety which dried through hot air oven drying was much better than that of sun drying and



	Locule number	Average weight (gm)	Pericarp thickness(cm)	Flesh(%)	Skin(%)	Seed(%)	Eadible index(%)	Waste index(%)
AzadT6	3.33	65.33	0.023	78.33	5.3	5.06	98.16	2.16
Angoorlata	2.33	46.33	0.0183	76.67	4.4	9	93.36	5.33

Figure 1. *Physical parameters of Angoorlata and Azad T6 Tomato.*

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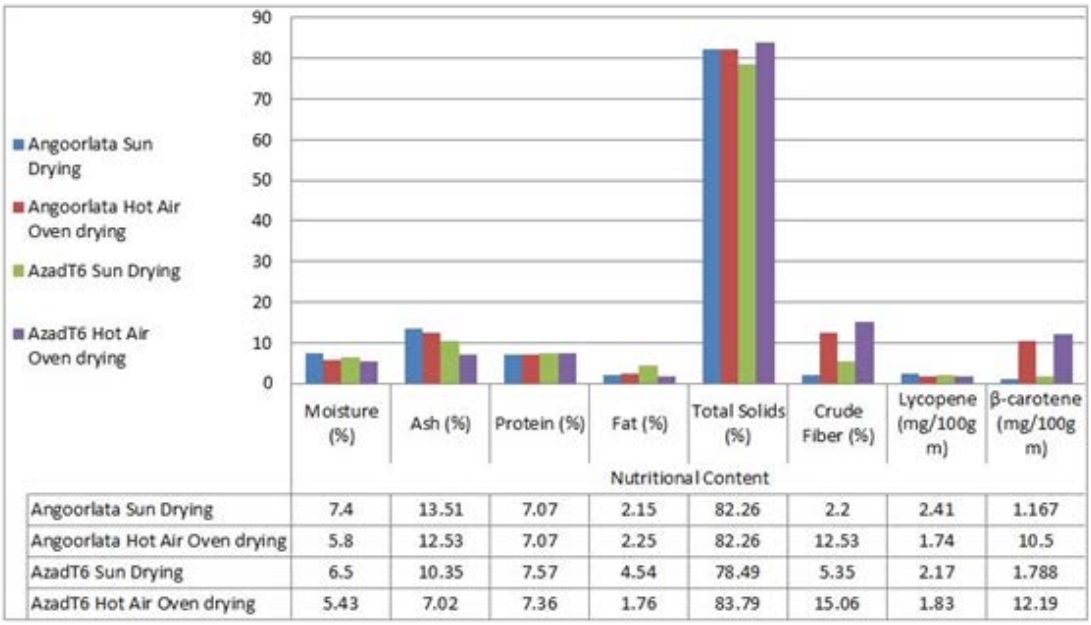
total yield was also more from hot air oven than sun drying method. Similar results were reported by Kalloo [11]. They also reported that the weight of final product also depend on the variety of tomato (Figure 2).

The results or end products of different processing methods differed from each other in texture, colour and odour. Hot air-dried sample had a slight burnt odour and was discoloured. Solar and sun drying samples were discoloured as sunlight was not uniform throughout drying. These processing methods resulted in loss of nutrients, and the samples were also inferior in quality. On the other hand, osmotic dehydration resulted in colour retention, better rehydration as compared to other samples. Also, loss of nutrients was less as this method does not expose samples to high processing temperatures for longer times. De Sousa showed that if the HMF content is greater than 20 mg/kg DM, it will change the colour from red to brown [12]. It could be seen from the Figure 1 that the moisture content of tomato powder varied from 6.5 to 7.4 per cent. Moisture content was not much depended on tomato varieties. But moisture content was higher in Angoorlata when compared to Azad T6 variety of tomato. The moisture content was not significantly affected by tomato varieties. The moisture content of tomato powder corresponds with the values reported by other studies [12,13]. The ash content in tomatoes were much affected by the varieties of tomato here we found the ash content were higher in Angoorlata (13.51%) when compared to Azad T6 (10.35%). The protein content ranged from 7.07 to 7.57 per cent in Angoorlta and Azad T6 tomato varieties respectively. The protein content was found higher in Azad T6 than Angoorlata.. Further student's t test showed that there was significant difference in protein content of tomato varieties. Gupta also reported that changes in protein content might be related to reactions i.e. non-enzymatic browning which was found to be more in fresh tomato than dried powder [13]. Similar results were reported by Rao [14]. The fat content was found to be 2.15% in Angoorlata tomato and 4.54% in Azad T6 tomato there was significant difference of fat content between them. Total solids were found to be higher in Angoorlata (82.26%) when compared to Azad T6 tomato (78.49%). The crude fibers in tomato powder were obtained in the range from 2.2 to 5.35% in Angoorlata and AzaT6 tomato respectively. The sun dried Angoorlata tomato showed highest ash content in (13.51%) as compared to sun dried Azad T6 tomato (10.35%). Similar results were reported by Jyothi and Raj [15]. The variation in the values of ash and fat content could be attributed to different varieties of tomato and degree of homogenization. Similar results were also reported by Rao [14].

It could be seen from the Figure 2 that lycopene and beta-carotene content in both the varieties of tomato powder were significantly different from each other. Similar result was observed by Kaur et al. [16]. Effects of drying methods and blanching on the lycopene values were found statistically significant (P>0.05). Among both the varieties, the highest lycopene content was observed by sun dried method in both the varieties of tomato. Hot air oven dried tomato varieties had lowest lycopene content when compared to sun drying. This result was found to be contradictory with the study of Davoodi

Table 1. *Effect of drying methods on Physical characteristics of tomato powder.*

Tomato Varieties	Drying Methods	Color Obtained	Total Yield (gm/kg)
Angoorlata	Sun drying	Redish brown	40
	Hot air oven drying	Red	42
AzadT6	Sun drying	Redish brown	43
	Hot air oven drying	Red	45



	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Total Solids (%)	Crude Fiber (%)	Lycopene (mg/100gm)	β-carotene (mg/100gm)
Angoorlata Sun Drying	7.4	13.51	7.07	2.15	82.26	2.2	2.41	1.167
Angoorlata Hot Air Oven drying	5.8	12.53	7.07	2.25	82.26	12.53	1.74	10.5
AzadT6 Sun Drying	6.5	10.35	7.57	4.54	78.49	5.35	2.17	1.788
AzadT6 Hot Air Oven drying	5.43	7.02	7.36	1.76	83.79	15.06	1.83	12.19

Figure 2. *Nutritional content of tomato powder.*

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et al. [17], they reported that the lowest retention of lycopene in sun dried samples and they explained that during sun drying the sample was exposed to air temperature for longer time which resulted in degradation of lycopene. Heat treatment disintegrated tomato tissue and increased exposure to oxygen and light, which resulted in the destruction of lycopene [18]. In the present investigation changes are mainly due to heat stress imposed by the relatively harsh thermal processes changes in the value of sun dried samples was found because sun drying was done at the month of February in northern hemisphere when humidity in weather was comparatively higher. The results suggest that length of heating is a critical factor controlling the degradation of lycopene. Higher retention of beta-carotene was found in hot air oven dried samples than sun dried samples. Beta-carotene is very sensitive to light. Retention of carotene after sun drying ranged between 1.67-1.78 mg/100 gm. Kowsalya reported carotene retention after sun drying from 1.77 to 1.4 mg/100 gm.

Drying provides extended shelf life, reduced transportation costs and minimized post-harvest losses, and it is an indispensable part in the food processing industry around the world. Sun drying and hot air oven drying have been used for drying of tomato slices.

Conclusion

Hot air oven dried tomato powder was found to be desirable in texture, colour and quality when compared to sun dried tomato powder. Hot air oven drying was done at temperature of 65°C for 24 hours in controlled condition while sun drying was done at uncontrolled condition.

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