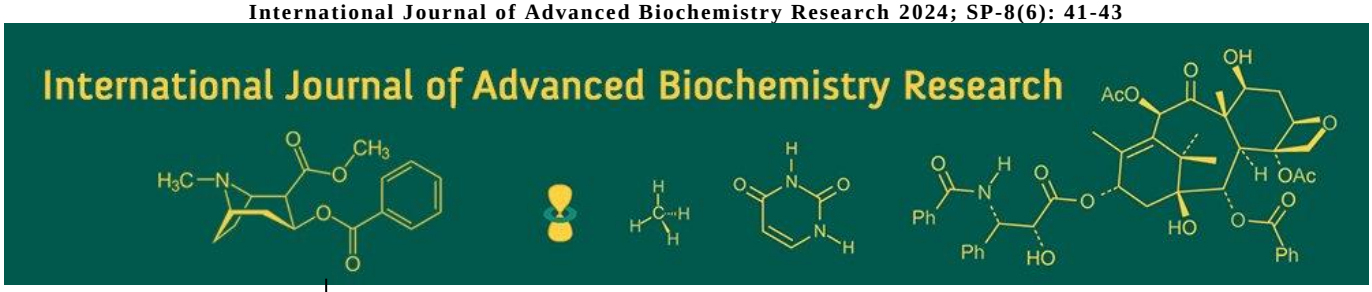

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(6): 41-43
www.biochemjournal.com
Received: 05-03-2024
Accepted: 12-05-2024

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Nutritional quality of dehydrated tomato slices as influenced by drying methods

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DOI: https://doi.org/10.33545/26174693.2024.v8.i6Sa.1248

Abstract
An investigation was conducted in the year 2017-2018 to evaluate nutritional quality of dehydrated tomato slices (*Solanum lycopersicon*) as influenced by drying methods. Experiment was conducted with two drying methods i.e., solar dryer and cabinet dryer. Tomato has great importance, mainly because of vitamins, minerals and dietary fibre. Fresh tomato fruits were selected, washed and dried by solar and cabinet dryer at 60 ^{0}C up to 6% moisture level. Observations were recorded up to storage period of six month at ambient conditions. Solar drying was found superior in protein, total sugars, reducing sugars, non-reducing sugars, total soluble solids ascorbic acid, titrable acidity with minimum moisture content as compared to cabinet drying. Drying methods showed non-significant difference in respect of crude fibre content of dried tomato slices. Solar dried slices maintained good nutritional status of dehydrated tomato slices during storage period.

Keywords: Tomato slices, solar drying, cabinet drying, dehydration, nutritional quality, storage
Abbreviations: KMS: Potassium Meta-bisulphite, $CaCl_2$: Calcium chloride

Introduction
Tomato (*Solanum lycopersicon*) is a warm season vegetable crop belongs to family Solanaceae. It is native of Peru and now widely cultivated throughout the tropics. Tomato is recognized as one of the most important "protective food" because of its special nutritive value and its wide range of production (Chaudhary, 1970).The average nutritional value per 100 gm of edible contain of Tomato fruit is moisture (93.1%), protein (1.9g), fat (0.1g), minerals (0.5g), carbohydrate (3.6g), vitamin A (320 IU), thiamine (0.07 mg), riboflavin (0.01 mg) ascorbic acid (31 mg), calcium (30 mg), magnesium (15 mg) and iron (1.8 mg) per of edible part (Bose *et al*., 2002) [2].

Dehydration is one of the best methods of preservation; the main principle of preservation of process is to remove the moisture content to a level where microorganism may not able to spoil the product. Food scientist have found that by reducing the moisture content of food in between 10-20% bacteria, yeast, mold and enzymes are all prevented from spoiling it. The flavor and most of the nutritional value is preserved and 3 concentrated. It also helps to minimize the substantial storage losses and also to avoid the fluctuation of market price during longer storage.

Dehydration results in concentration of nutrients. It is one of the most possible strategies for preservation of fruits and vegetable which are highly seasonable and perishable too. The art of drying food stuff especially of fruits and vegetable is very old and in modern times it is being done on improved scientific lines. There is various method of preservation of vegetables, but dehydration is mostly used. Dehydrated vegetables are good source of energy minerals and vitamins. Some provide moderate amount of protein to diet and they are concentrated nutrients. In the process of drying or dehydration, sufficient moisture is removed and thus the product is ensured against spoilage. To achieve the target of feeding the increasing population as well as meeting the requirements of the raw material for processing industry and export trade, only increase in area and productivity of crops are not enough. Much attention needs to be given on post-harvest management and value addition of these perishable vegetable crops.

Materials and Methods

The study was conducted in post-harvest technology laboratory at university, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during 2017-2018. The selected tomato fruits were cut manually with stainless steel knife and prepared slices of 0.5 cm thickness. Slices were allowed for pre-treatment i.e., dipping in solution of 1 g $CaCl_2$ per 100 g + Potassium metabisulphite (KMS) 0.2 g per 100 g for 10 minutes. At the end of treatment period, the slices were taken out and drained and dried in solar drying (D_1) and cabinet drying (D_2) at 60 °C upto 6% moisture level. After drying, the dried slices were packed in packaging materials and stored at room temperature upto 180 days from drying (Manimegalai and Ramah, 1999 and Shams Ud-Din and Shraji, 2008) [5, 12]. Chemical analysis of slices were done at 30 days interval upto 180 days of storage. The physical and chemical parameters like moisture, protein, total sugar, reducing sugar, non-reducing sugar, ascorbic acid, total soluble solids, titrable acidity and crude fibre content were determined according to methods given by Ranganna (1979) [10].

Results and Discussion

The present investigation were undertaking with an objective to standardized the drying method for preparation of good quality tomato slices. Tomato slices retained in good nutritional quality after six months storage at ambient temperature. Physical and chemical properties of dehydrated tomato slices are Present in Table 1 and 2.

The perusal of data presented in Table 1 showed that, solar dried tomato slices had minimum moisture (10.47%) while cabinet dried had maximum (10.60%) moisture content at 180 days after storage. The progressive increase in moisture content was noticed in all the samples due to hygroscopic nature of slices during storage. Yeboah *et al*. 2016 [13] in and Giri *et al*. 2017 [4].

Solar dried slices showed maximum protein content (11.65%) while cabinet dried tomato slices showed minimum protein content (11.43%) during storage period. The decreasing trend might be due to gain of moisture from atmosphere. Denaturation of protein is brought about by heat in presence of moisture Sarker *et al.* 2014 [11] and Giri *et al.* 2017 [4].

The critical appraisal of data show that solar dried tomato slices showed maximum total sugar (20.29%) while cabinet dried slices showed minimum total sugar (19.97%) during storage period. The increasing trend might be due to activity of invertase or amylase Pawar *et al.* 1985 [8] for dehydrated pumpkin slices, Osunde and Musa Mukama 2007 [7] for sun dried tomatoes.

Observation recorded in Table 1 reflected that, the tomato slices dried in solar drier had maximum reducing sugar (18.61 mg/100g) as compared to cabinet dried slices (18.32 mg/100g) at 180 days of storage. The increasing trend might be due to activity of invertase or amylase and also increase in sugars which could be attributed to the conversion of non reducing sugars to reducing sugars during drying Pawar *et al.* (1985) [8] for dehydrated pumpkin slices, Osunde and Musa Mukama 2007 [7] for sun dried tomatoes.

The data presented in Table 2 showed that, solar dried tomato slices had maximum non reducing sugar (1.67%) while cabinet dried had minimum (1.64%) non reducing sugar content at 180 days after storage. The increasing trend might be due to activity of invertase or amylase Pawar *et al.* 1985 [8] for dehydrated pumpkin slices.

Table 1: Effect of drying methods on physico-chemical parameters of dehydrated tomato slices

	Physico-chemical parameters											
Treatments	**Moisture (%)**			**Protein (%)**			**Total sugars (%)**			**Reducing sugars (%)**		
Drying methods	1st day	90th day	180th day	1st day	90th day	180th day	1st day	90th day	180th day	1st day	90th day	180th day
D_1- solar drying	5.81	8.13	10.47	13.20	12.23	11.65	17.60	19.82	20.29	16.47	18.26	18.61
D_2-Cabinet drying	5.80	8.24	10.60	13.20	12.07	11.43	17.60	19.53	19.97	16.47	18.00	18.32
'F' test	NS	Sig.	Sig.	NS	Sig.	Sig.	NS	Sig.	Sig.	NS	Sig.	Sig.
SE(m) +	0.002	0.001	0.002	0.002	0.001	0.001	0.003	0.0003	0.003	0.003	0.003	0.003
CD at 5%	-	0.004	0.006	-	0.003	0.003	-	0.008	0.009	-	0.008	0.009

Observation recorded in Table 2 reflected that, the tomato slices dried in solar drier had maximum ascorbic acid content (22.12 mg/100g) as compared to cabinet dried slices (21.93 mg/100g) at 180 days of storage. The decreased trend of ascorbic acid content was observed mostly due to its oxidation during the storage period and also ascorbic acid is very sensitive to heat. It might be lost due to application of heat during drying. An antioxidant that might have reduced the discoloration of the dried tomato slices Aggarwal *et al*. 2016 [1].

Solar dried slices had maximum (0.39%) titrable acidity while cabinet dried tomato slices had minimum (0.36%) titrable acidity during storage period. The increasing trend might be due to conversion of some amount of sugars into acid. Increase in acidity is not only due to pre-treatments but also due to drying methods Aggarwal *et al*. 2016 [1].

Table 2: Effect of drying methods on physico-chemical parameters of dehydrated tomato slices

	Physico-chemical parameters														
Treatments	**Non Reducing sugars (%)**			**Ascorbic acid (mg/100g)**			**TSS (%)**			**Titrable acidity (%)**			**Crude Fibre content (%)**		
Drying methods	1st day	90th day	180th day	1st day	90th day	180th day	1st day	90th day	180th day	1st day	90th day	180th day	1st day	90th day	180th day
D_1- solar drying	1.12	1.56	1.67	24.32	22.89	22.12	7.30	7.76	8.22	0.64	0.48	0.39	11.20	11.13	11.06
D_2-Cabinet drying	1.14	1.52	1.64	24.32	22.78	21.93	7.30	7.70	8.13	0.64	0.46	0.36	11.20	11.13	11.07
'F' test	NS	Sig.	Sig.	NS	Sig.	Sig.	NS	Sig.	Sig.	NS	Sig.	Sig.	NS	NS	NS
SE(m) +	0.003	0.003	0.002	0.003	0.005	0.004	0.010	0.003	0.006	0.002	0.002	0.002	0.002	0.002	0.002
CD at 5%	-	0.008	0.005	-	0.015	0.011	-	0.008	0.017	-	0.006	0.005			

Solar dried slices had maximum (8.22%) total soluble solids while cabinet dried tomato slices had minimum (8.13%) total soluble solids during storage period. The increasing trend might be due to the hydrolysis of polysaccharides and their subsequent conversion to reducing sugars as evidence by decreasing the starch content of tomato slices. Mane 2010 [5] and Radwan and Malak 2002 [9] for tomato powder and slices.

Crude fibre content of tomato slices decreased during storage period but there was non-significant influence of drying methods on crude fibre content of tomato slices.

Conclusion

The physico-chemical parameters like moisture, total sugars, reducing sugars, non-reducing sugars, total soluble solids content showed increasing trend with advancement of storage, irrespective of drying methods. Chemical components like protein, ascorbic acid, titrable acidity were decreased during storage period. Qualitative products were obtained in solar drying as compared to cabinet drying.

Acknowledgements

The authors are thankful to staff members and respected staff members and respected professors of Dr. PDKV, Akola, for providing the necessary facilities for the research experiment.

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