Original Research Article

Effect of blanching pre-treatments on sensory quality of dragon fruit peel pickle

Abstract

Present investigation entitled effect of blanching pre-treatments on quality of dragon fruit peel picklewas aimed to evaluate sensory quality of dragon fruit peel pickleduring storage. For preparation of dragon fruit peel pickle, an experiment was laid out with six blanching pre-treatments [without blanching (T_1), water blanching (T_2), 0.5 % citric acid blanching (T_3), 1.0 % citric acid blanching (T_4), 0.5 % alum (potassium aluminium sulphate) blanching (T_5) and 1.0 % alum (potassium aluminium sulphate) blanching (T_6)]. The prepared pickle was stored for a period of 6 month to analyse the sensory quality attributes at three month intervals. The results of the investigation revealed that dragon fruit peel pickle prepared from peel blanched in 1 per cent citric acid (T_4) observed to have maximum colour, taste, flavour, texture and overall acceptabilityscore.Overall findings of investigation revealed that best sensory quality dragon fruit peel pickle can be prepared from peel when blanched in 1 per cent citric acid followed by curing in 8 per cent salt and addition of ingredients. The dragon fruit peel pickle can be successfully stored for a period of six months with minimum changes in sensoryquality.

Keywords: Dragon fruit peel, Citric acid, Alum, Sensory

Introduction

Dragon fruit, known as pitaya or pitahaya belongs to the Cactaceae family and is prevalent in two separate genera namely, ‘Hylocereus’ and ‘Selenicereus’. The most common commercially cultivated varieties belongs toHylocereus genus covering around 16 different species. It is also called as strawberry pear, thangloy (Vietnamese), pitayaroja (Spanish),la pitahaya rouge (French) andkamalam (Hindi). Dragon fruit has great potential as a new crop for mediterranean growers due to the requirement of little water and well adaption to the high temperatures (Trivellini*et al*., 2020). The cultivation is prominent in about 20 countries including Thailand, Indonesia, Taiwan, Vietnam, India, Srilanka, Bangladesh, Japan, Malaysia, Philippines, Australia, United States, and China. There are three varieties that are grown commercially includes, *Hylocereusundatus* (white dragon fruit), *Hylocereuspolyrhizus* (red dragon fruit) and *Selenicereusmegalanthus* (yellow dragon fruit) (Jalgaonkar*et al*., 2022). It contributes to the food security of millions of people in the developing world.

Gazing at the recent dragon fruit production scenario of 2018-2019, India is the producer of dragon fruit with annual production of 4200 ton from an area of 400 ha with 10.5 t/ha productivity (Wakchaure, *et. al.* 2021).

In India, the indigenous fruits are processed into a number of value added products like, jam, juice, jelly, cheese, preserves *etc*. But the exotic dragon fruit processed products are rarely available in our markets as well as very little work has been done on processing of dragon fruit in India. So the scope for utilizing dragon fruit remains bright in India. A number of locally processed fruit products are now available in the market. If quality products from dragon fruit are developed, it might be welcomed by the consumers, because of this dragon fruit has gained much interest in the society due to its exotic features attractive colours, nutritional value and pleasant taste. Development of pickle by utilizing local produce is critically important for expansion of food industries. Therefore this study was planned keeping in view on medicinal and nutritional importance of dragon fruit peel, to utilize peel for preparation ofpickle for commercial exploitation.

Physico-chemical properties of the discarded dragon fruit peel can be determined inorder to evaluate its potential for recovery of value-added materials. The moisture content of the peel reported approximately 92.7per cent and found low in total soluble solids, protein, ash and fat content. Betacyanin pigment(150.46 ± 2.19 mg/100 g) and pectin (10.8%) reported high in the peel. Glucose, maltose and fructose detectedin the peel but not sucrose and galactose. The peel also had very high insoluble and soluble dietary fibre whichhad exhibited a good ratio of insoluble dietary fibre to soluble dietary fibre (3.8:1.0).The peel of dragon fruit possess higher radical scavenging activity than the pulp andthus could be a good source of antioxidants. The compoundsdetected in the peel are chlorogenic acid, gallicacid, and quercetin.

Dragon fruit peels account for approximately25per cent of the fruit's weight and contain a large varietyof bioactive compounds (e.g., phenolics, betacyanin,vitamins, *etc*.). They have been proven to producehigher amounts of phenolic compounds (1.4 timesin red-fleshed and 9.6 times in white-fleshed species)and antioxidant capacities than the pulp. Several studies have also reported that dragonfruit peels have higher cancer cell antiproliferationthan their pulps (Luo *et al*., 2014). The antioxidants in dragon fruit peelmay include chlorogenic acid, gallic acid and quercetin(Lourith and Kanlayavattanakul, 2013). Peel also possessa natural appealing red color due to the presenceof betacyanin compounds that have a high stability underappropriate storage conditions (Woo *et al*., 2011).Fresh and

dried dragonfruit skin found rich in pectins and betalains making itnatural food thickener and natural colouring agent.

Pickles are preserved products prepared with salt alone or in combination with chilli and other spices and stored at room temperature for off-season utilization. The maintenance of dragon fruit peel colour is major problems in preparation of pickle. So, there is urgent need to standardize the pre-treatments for preparation of pickle from dragon fruit peel. Further, the quality of dragon fruit peel pickle also needs the evaluation before going for commercialization of products.

Materials and method

The fresh ripe dragon fruit were selected and washed with running tap water followed by trimming and peeling. The peel was cut into 12×17 mm±2 mm pieces. After that, the peel pieces were blanched as per treatment (control, blanching, 0.5 % CA, 1 % CA, 0.5 % alum and 1 % alum) at 95 ^{o}C temperature for 5 min followed by draining to remove excess surface moisture. After pre-treatments, 4 per cent salt (NaCl) was added into the peel pieces, followed by mixing and then kept for 6 hours. After 6 hours, again additional 4 per cent salt (NaCl) was mixed and kept for 6 hours. The salt solution obtained due to mass transfer out from the peel pieces after 12 hours was discarded. Pickle of different treatments were prepared by addition of ingredients as shown in recipe. All the ingredients were taken in stainless steel vessels and added into the warm oil. After that blanched dragon fruit peel pieces were added into the oil containing salt and spices and mixed thoroughly with slow heating for 4-5 min. The prepared samples were then packed in glass jar and stored at room temperature for further analysis and to record observations. Principal steps used for preparation of dragon fruit peel pickle has been presented in Fig. 1.

Recipe for making pickle: The recipe for the preparation of dragon fruit peel based pickle comprised of 1 kg peel pieces, 350 ml mustard oil, 25 g fenugreek, 22 g chilli powder, 10 g cumin, 6 g turmeric powder, 2 g asafoetida and 10 g coriander, 10 g fennel, 5 ml acetic acid and 1 g sodium benzoate.

Selection of dragon fruit
↓
Peeling
↓
Preparation of pieces (1 × 1.5 cm)
↓
Pre-treatments of pieces (As per treatments)

↓

Addition of salt (8%)

↓

Heating of mustard oil

↓

Addition of spices in warm oil

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Addition of dragon fruit peel pieces and mix it thoroughly

↓

Slow heating for 4-5 min

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Addition of acetic acid and sodium benzoate

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Filling of the product in pre-sterilized glass jar and storage

Fig 1: Flow chart for preparation of dragon fruit peel pickle

Results and Discussion

Colourscore

Perusal of data pertaining to effect of blanching pre-treatments on colourscore of dragon fruit peel pickle during six months storage has been presented in Table 1.

Effect of pre-treatments: Data showed that among different blanching pre-treatments, the mean colourscore of dragon fruit peel pickle (T) significantly varied between 6.49 and 7.36, with maximum colourscore in pickle which was prepared from peel which was blanched along with 1.0 per cent citric acid (T_4) and minimum colourscore in pickle prepared from unblanched dragon fruit peel (T_1). Alam *et al*. (2014) reported similar findings with significant effect in colourscore of carrot powder.

Effect of storage: Data depicted that storage of dragon fruit peel pickle resulted significant decrese in mean colourscore (S) from 7.30 to 6.48 (S_0 to S_2) during six months. Sangeeta *et al.* (2016) also reported gradual decrease in colourscore of litchi aril during storage. Decrease in colourscore during storage might be due to degradation of pigments.

Table 1: Effect of different treatments on colour score of dragon fruit peel pickle

Treatment (T)	Colourscore (9 point Hedonic scale)			Mean (T)
	Storage (S)			
	S_0- Initial	S_1- 3 Month	S_2- 6 Month	
$T_{1\ (C)}$	7.00	6.47	6.00	**6.49**
$T_{2\ (B)}$	7.17	6.67	6.00	**6.61**
$T_{3\ (BC\ 0.5\ \%)}$	7.33	7.00	6.67	**7.00**
$T_{4\ (BC\ 1.0\ \%)}$	7.67	7.40	7.00	**7.36**
$T_{5\ (BA\ 0.5\ \%)}$	7.20	6.83	6.33	**6.79**

$T_{6\ (BA\ 1.0\ \%)}$	7.40	7.17	6.87	**7.15**
Mean (S)	**7.30**	**6.92**	**6.48**	**6.90**
S.Em.±	**T**	**S**	**T×S**	**CV %**
	0.040	0.033	0.070	T:1.75
$CD_{0.05}$	0.116	0.131	0.201	S:2.06

4.5.2.3 Taste score

Perusal of data pertaining to effect of blanching pre-treatments on taste score of dragon fruit peel pickle during six months storage has been presented in Table 2.

Effect of pre-treatments: Data showed that among different blanching pre-treatments, the mean taste score of dragon fruit peel pickle (T) significantly varied between 6.69 and 6.97, with maximum taste score in pickle which was prepared from peel which was blanched along with 1.0 per cent citric acid (T_4) and minimum taste score in pickle prepared from water blanched peel only (T_2). Similar observation was recorded by Desayi (2012) for partial dehydrated mushroom.

Effect of storage: Data depicted that storage of dragon fruit peel pickle resulted significant increase in mean taste score (S) from 6.33to 7.11 (S_0 to S_2) during six months. Haokip (2013) also reported gradual increase in taste score of mango pickle during storage.

Table 2: Effect of different treatments on tastescore of dragon fruit peel pickle

Treatment (T)	**Taste score (9 point Hedonic scale)**			**Mean (T)**
	Storage (S)			
	S_0- Initial	**S_1- 3 Month**	**S_2- 6 Month**	
$T_{1\ (C)}$	6.25	6.89	7.00	6.71
$T_{2\ (B)}$	6.25	6.83	7.00	6.69
$T_{3\ (BC\ 0.5\ \%)}$	6.33	6.83	7.00	6.72
$T_{4\ (BC\ 1.0\ \%)}$	6.42	7.17	7.33	6.97
$T_{5\ (BA\ 0.5\ \%)}$	6.33	7.00	7.17	6.83
$T_{6\ (BA\ 1.0\ \%)}$	6.42	7.00	7.17	6.86
Mean (S)	**6.33**	**6.95**	**7.11**	**6.80**
S.Em.±	**T**	**S**	**T×S**	**CV %**
	0.052	0.024	0.090	T:2.29
$CD_{0.05}$	0.149	0.094	NS	S:1.50

Flavour score

Perusal of data pertaining to effect of blanching pre-treatments on flavourscore of dragon fruit peel pickle during six months storage has been presented in Table 3.

Effect of pre-treatments: Data showed that among different blanching pre-treatments, the mean flavourscore of dragon fruit peel pickle (T) varied between 6.62 and 6.77, with maximum flavourscore in pickle which was prepared from peel which was blanched along with 1.0 per cent alum (T_6) and minimum flavourscore in pickle prepared from unblanched dragon fruit peel (T_1) and water blanched peel only (T_2). Similar observation was recorded by Bairwa *et al*. (2018) for pretreated aonla powder added in ready to serve beverage.

Table 3: Effect of different treatments on flavourscore of dragon fruit peel pickle

Treatment (T)	Flavour score (9 point Hedonic scale)			Mean (T)
	Storage (S)			
	S_0- Initial	S_1- 3 Month	S_2- 6 Month	
$T_{1\ (C)}$	6.33	6.61	6.92	**6.62**
$T_{2\ (B)}$	6.33	6.61	6.92	**6.62**
$T_{3\ (BC\ 0.5\ \%)}$	6.50	6.72	7.00	**6.74**
$T_{4\ (BC\ 1.0\ \%)}$	6.50	6.77	7.00	**6.76**
$T_{5\ (BA\ 0.5\ \%)}$	6.50	6.72	7.00	**6.74**
$T_{6\ (BA\ 1.0\ \%)}$	6.50	6.77	7.05	**6.77**
Mean (S)	**6.44**	**6.70**	**6.98**	**6.71**
S.Em.±	**T**	**S**	**T×S**	**CV %**
	0.053	0.058	0.091	T:2.36
CD $_{0.05}$	NS	0.226	NS	S:3.64

Effect of storage: Data depicted that storage of dragon fruit peel pickle resulted significant increase in mean flavourscore (S) from 6.44 to 6.98 (S_0 to S_2) during six months. Haokip (2013) also reported gradual increase in flavourscore of mango pickle during storage. Similar significant increase in flavourscore was also reported by Bairwa *et al.* (2018) in pretreated aonla powder added in ready to serve beverage.

Texture score

Perusal of data pertaining to effect of blanching pre-treatments on texture score of dragon fruit peel pickle during six months storage has been presented in Table 4.

Effect of pre-treatments: Data showed that among different blanching pre-treatments, the mean texture score of dragon fruit peel pickle (T) varied between 7.32 and 7.50, with maximum texture score in pickle which was prepared from peel which was blanched along with 1.0 per cent citric acid (T_4) and 1.0 per cent alum (T_6) and minimum texture score in pickle prepared from water blanched peel only (T_2). However, effect of treatment was found to have non-significant effect. Similar observation was recorded by Arendse andJideani (2022) for moringa powder.

Effect of storage: Data depicted that storage of dragon fruit peel pickle resulted significant increase in mean texture score (S) from 7.12 to 7.70 (S_0 to S_2) during six months. Haokip (2013) also reported gradual increase in texture score of mango pickle during storage. Similar significant increase in texture score was also reported by Singh (2021) in cauliflower pickle. Increase in texture score during storage might be due to softening of pickle as reported by Sharma (2002) in lime pickle during storage.

Table 4: Effect of different treatments on texturescore of dragon fruit peel pickle

Treatment (T)	Texture score (9 point Hedonic scale)			Mean (T)
	Storage (S)			
	S_0- Initial	S_1- 3 Month	S_2- 6 Month	
$T_{1\ (C)}$	7.17	7.33	7.60	**7.37**
$T_{2\ (B)}$	7.00	7.37	7.60	**7.32**
$T_{3\ (BC\ 0.5\ \%)}$	7.11	7.43	7.67	**7.40**
$T_{4\ (BC\ 1.0\ \%)}$	7.17	7.50	7.83	**7.50**
$T_{5\ (BA\ 0.5\ \%)}$	7.11	7.43	7.67	**7.40**
$T_{6\ (BA\ 1.0\ \%)}$	7.17	7.50	7.83	**7.50**
Mean (S)	**7.12**	**7.43**	**7.70**	**7.42**
S.Em.±	**T**	**S**	**T×S**	**CV %**
	0.049	0.046	0.085	T:1.99
CD $_{0.05}$	NS	0.180	NS	S:2.62

Overall acceptability score

Perusal of data pertaining to effect of blanching pre-treatments on overall acceptability score of dragon fruit peel pickle during six months storage has been presented in Table 5.

Effect of pre-treatments: Data showed that among different blanching pre-treatments, the mean overall acceptability score of dragon fruit peel pickle (T) significantly varied between 6.80 and 7.15, with maximum overall acceptability score in pickle which was prepared from peel which was blanched along with 1.0 per cent citric acid (T_4) and minimum overall acceptability score in pickle prepared from unblanched dragon fruit peel (T_1) and water blanched peel only (T_1). Similar observation was recorded by Jyoti *et al.* (2016) for mushroom pickle.

Effect of storage: Data depicted that storage of dragon fruit peel pickle resulted significant increase in mean overall acceptability score (S) from 6.80 to 7.07 (S_0 to S_2) during six

months. Haokip (2013) also reported gradual increase in overallacceptability score of mango pickle during storage. Similar significant increase in overall acceptability score was also reported by Singh (2021) in cauliflower pickle. Increase in overall acceptability score during storage might be due to use of many raw materials which were soluble in water as reported by Azzawi and Abdullah (2019) in pickle during six months storage.

Table 5: Effect of different treatments on overall acceptabilityscore of dragon fruit peel pickle

Treatment (T)	Overall acceptability score(9 point Hedonic scale)			Mean (T)
	Storage (S)			
	S_0- Initial	S_1- 3 Month	S_2- 6 Month	
$T_{1\ (C)}$	6.69	6.83	6.88	6.80
$T_{2\ (B)}$	6.69	6.87	6.88	6.80
$T_{3\ (BC\ 0.5\ \%)}$	6.82	7.00	7.09	6.97
$T_{4\ (BC\ 1.0\ \%)}$	6.94	7.21	7.29	7.15
$T_{5\ (BA\ 0.5\ \%)}$	6.78	7.00	7.04	6.94
$T_{6\ (BA\ 1.0\ \%)}$	6.87	7.11	7.23	7.07
Mean (S)	**6.80**	**7.00**	**7.07**	**6.96**
S.Em.±	**T**	**S**	**T×S**	**CV %**
	0.027	0.018	0.047	T:1.17
CD $_{0.05}$	0.078	0.071	NS	S:1.11

Conclusion

Overall from the findings of investigation it can be concluded dragon fruit peel pickle can be prepared from peel when blanched in 1 per cent citric acid followed by curing in 8 per cent salt and addition of ingredients. The pickle prepared from the above treatment, possess higher sensory quality attributes during storage. Thus, the developed technology can commercially be adopted by food processing industry for the production of pickle by utilizing dragon fruit peel.

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