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Physico-chemical Evaluation of the Squash prepared from different Varieties of Peach

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ABSTRACT: An investigation was conducted in 2020-21 to evaluate the physio-chemical characteristics of the postharvest product *i.e.,* squash of three cultivars of freshly harvested mature fruits of peach cvs. Florda Prince, Early Grande and Shan-e-Punjab. It was found that maximum TSS (47.27), titratable acidity (1.52) and ascorbic acid (13.71) was obtained by combination of 35% Pulp and 45% sugar concentrations in Shan-e-Punjab cultivar followed by Early Grande while lowest TSS occurred with 25% pulp + 40% sugar level in most of the combinations. The maximum reducing sugar (4.77) and total sugar (20.69) was obtained by combination of 35% Pulp and 45% sugar concentrations in Florda Prince cultivar followed by Early Grande cultivar while it was found minimum in Shan-e-Punjab cultivar with the combination of 25% Pulp and 40% sugar. It has very challenges to identifying the good variety of peach for the preparation of better squash. According to the study, the low chill peach cultivars Shan-e-Punjab and Florda Prince may be suggested for the creation of squash with a formulation of 35% pulp, 40% sugar, and 1% acid in order to satisfy customer taste and preferences.

Keyword: Postharvest, Physio-chemical, Squash Florda Prince, Early Grande, Shan-e-Punjab.

INTRODUCTION

Peach (*Prunus persica* L.) is a magnificent fruit crop belonging to family Rosaceae. It is native to China, from where it diversified to the all over the world (Kunda *et al.,* 2012). Due to its unique characteristics among the stone fruits, Peach is the third most important temperate fruit crop of India. Cultivation of peach has attained significant notice during the past few years and furthermore there is a great scope. In India low chill peaches are mostly grown in Punjab, Haryana, Western Uttar Pradesh, Himachal Pradesh and Uttarakhand (Bal, 2018). Peach is also cultivated in a very limited scale in the hills of south India and north eastern region of India. Consumers today seek out foods that serve several purposes, and fruit quality is increasingly determined by its nutritional (minerals, vitamins, dietary fibre), as well as its health-promoting (antioxidant) qualities (Crisosto and Costa, 2008; Reig *et al.,* 2013). Peaches are generally used as table fruits due to their wonderful colours and high texture. It is also a good source of minerals like phosphorus, potassium and iron and vitamins along with low calorific diet (Krishnan and Meera 2018). As compared to most other common fruits that are used for table purpose, peaches contain fairly good amount of vitamins, proteins, carbohydrates, ascorbic acid and minerals (Singh *et al.,* 2016). Introduction of new variety or crop cultivars provides an ample opportunity for crop diversification in a particular weather condition to check economic feasibility for growing them commercially (Jana, 2015). Peach fruit protects us from dryness of skin, night blindness and formation of ulcer (Singh *et al.,* 2017). Peach fruit is a potential source of bioactive compounds (cancer, heart disease), offering medicinal benefits such as potential protection from various chronic diseases (Kim *et al.,* 2014). Peaches are also a strong source of potassium, which supports heart health maintenance and the management of high blood pressure. In Additionally, it bolsters heart muscles (Crociani *et al.,* 2001). Prunacin is the main glycoside present in the pulp of peach (Cirilli *et al.,* 2016). Peaches are extremely perishable fruit and have a short life span under ambient conditions. The factors that contribute to the short shelf life of this fruit include rapid metabolism because of high respiration rate, fungal decay after harvest, weight loss, physiological disorders, internal browning and textural changes (Li-qin *et al.,* 2011; Jana, 2015). Peach fruits are the most appreciated fruit by the consumers both in terms of processed and fresh forms due to their special characteristics in terms of taste, flavour, appearance, sweetness and juiciness. It has colour appeal, appetite and is most refreshing (Ghasemnezhad *et al.,* 2010). Significant percentage of fresh peaches are processed into various value added items such as squash, juices, canned slices, nectar, pickle, jam etc due to their limited life period, seasonal availability and perishable nature. Some work has been done on squash and canning of peaches (Aggarwal *et al.,* 2010) but only meagre studies are available on the processing suitability of these cultivars into squash, canned and pulp based

products. The fruit is often consumed as fresh but squash which is prepared from the peach is very pleasing to the buds. Peach can also be processed as juice, canned, frozen preserves, jam, nectar, marmalade and dried products etc. Fruit squash is a type of beverages which is having 25 per cent of pulp or juice to which cane sugar is added for sweetness to rise the TSS above the 40°Brix value and made up to volume by dilution with chilled water like Peach squash, orange squash, plum squash etc. (Sharma, 2010). Due to its perishable nature farmers are unable to get higher returns for the produce. Therefore, by preserving and utilizing fresh fruits into various value added products is the only viable option to get additional returns (Alam and Khatun 2021). Ready-to-serve, squash and diluted beverages are one of the best and commonly acceptable drinks now-a-days all over the world. Retention of medicinal, nutritional and calorific properties in fruit based beverages and squashes are the main reason for their preference over the non-fruit based beverages all over the world. By choosing the proper fruit drink processing parameters, processing fruit as squash improves both the fruit's raw edible quality and its shelf-life (Nida-Saleem *et al.,* 2011). Hence, the present investigation was carried out to assess the suitability of three low chill peach cultivars *viz.,* Florada Prince, Early Grand and Shan-e-Punjab grown under Tarai condition of Uttarakhand for their suitability to "squash" drink.

MATERIAL AND METHOD

An investigation was conducted in the postharvest laboratory of the Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar. The experimental materials consisted of freshly harvested mature fruits of peach cvs. Florda Prince, Early Grande and Shan-e-Punjab were collected during last week of April to first week of May, 2020. Harvesting of firm and ripe fruits of Florda Prince was done on 24th April, Early Grande on 29th April and Shan-e-Punjab on 5th May, 2020. Squash should contain at least 25% fruit juice or pulp and 40 to 50% total soluble solids commercially. About 1% citric acid and 350 ppm sulphur dioxide or 600ppm sodium benzoate are added as preservatives. FSSAI specifications were followed for preparation of squash from pulp of peach fruits are present in the Fig 1. Different combinations of pulp (%) and TSS (ºB) were used to prepare squash from pulp of all three cultivars (Table 1). Sugar syrup was prepared with the addition of water, sugar and citric acid according to the formulation. The concentration of acid (as citric acid) was kept constant @ 1.0% in all combinations. Potassium metabisulphite (KMS) @ 350 ppm was mixed properly at the end of product preparation. The squash was filled in previously sterilized plastics bottles leaving adequate head space and sealed. Fruit pulp and squash of each cultivar per replication per treatment was used for determining TSS by using hand refractometer (MSW 503, Make-Macro Scientific Works) at room temperature and expressed in terms of degree brix. The percent titratable acidity (as maleic acid), Total sugars and Reducing sugars was determined in peach pulp and squash as per method described by (Ranganna, 1986). Ascorbic acid content of fruit pulp/squash was determined by 2, 6-dichlorophenol indophenols visual titration method also described by (Ranganna, 1986). The organoleptic quality of squash prepared from peach pulp was determined using taste panel consisting of eight panellists drawn from research students/faculty of Department of Horticulture. The panellists were asked to evaluate the squash samples for different quality attributes namely colour, flavor, taste, texture and overall acceptability.

Table 1: Details of the treatment combinations for squash preparation.

Treatments	Cultivar	Pulp (%)	TSS(%)	Combinations
T_1	Florda Prince	25	40	$C_1P_1S_1$
T_2	Florda Prince	25	45	$C_1P_1S_2$
T_3	Florda Prince	30	40	$C_1P_2S_1$
T_4	Florda Prince	30	45	$C_1P_2S_2$
T_5	Florda Prince	35	40	$C_1P_3S_1$
T_6	Florda Prince	35	45	$C_1P_3S_1$
T_7	Early Grande	25	40	$C_2P_1S_1$
T_8	Early Grande	25	45	$C_2P_1S_2$
T_9	Early Grande	30	40	$C_2P_2S_1$
T_{10}	Early Grande	30	45	$C_2P_2S_2$
T_{11}	Early Grande	35	40	$C_2P_3S_1$
T_{12}	Early Grande	35	45	$C_2P_3S_2$
T_{13}	Shan-e-Punjab	25	40	$C_3P_1S_1$
T_{14}	Shan-e-Punjab	25	45	$C_3P_1S_2$
T_{15}	Shan-e-Punjab	30	40	$C_3P_2S_1$
T_{16}	Shan-e-Punjab	30	45	$C_3P_2S_2$
T_{17}	Shan-e-Punjab	35	40	$C_3P_3S_1$
T_{18}	Shan-e-Punjab	35	45	$C_3P_3S_2$

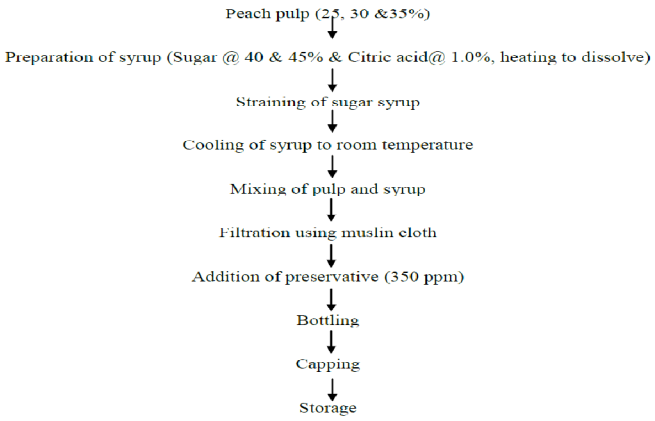

Fig. 1. Preparation of squash from peach pulp.

RESULT AND DISCUSSION

Total soluble solids. It is evident from the data (Fig. 2-4) that TSS content of peach squash increase with the increase in pulp and sugar proportions. TSS content in all the squash combinations ranged from 41.17 to 47.27. The TSS of all fruit squashes increased significantly but there were no significant differences observed between the cultivars. The maximum TSS (47.27) was obtained by combination of 35% Pulp and 45% sugar concentrations in Shan-e-Punjab cultivar. The interaction between ratio of pulp and sugar concentrations significantly influenced the TSS percentage of squash and the highest value was occurred with 35% pulp + 45% sugar level while lowest TSS occurred with 25% pulp + 40%sugar level in most of the combinations. A low chill peach cultivar Shan-e-Punjab total soluble solids (TSS) was found highest during the fruit growth and development (Babu *et al.,* 2011). Squash's increased TSS content could be the result of the hydrolysis process, which turns polysaccharides into sugars (Papade *et al.,* 2015).

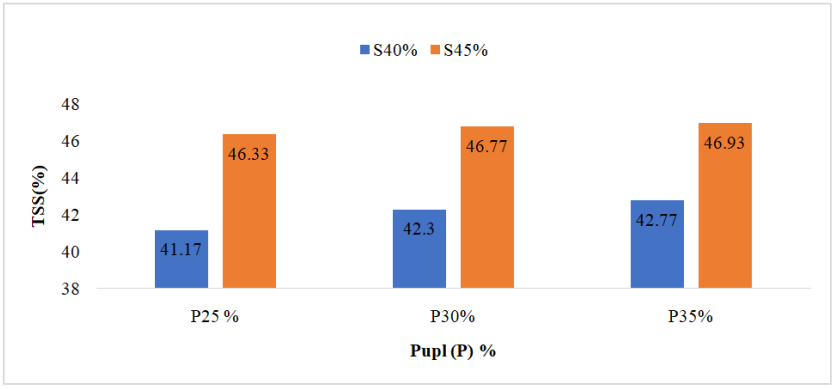

Fig. 2. Interaction effect of pulp (P) % and sugar(S) % on TSS of Florida Prince variety of Peach.

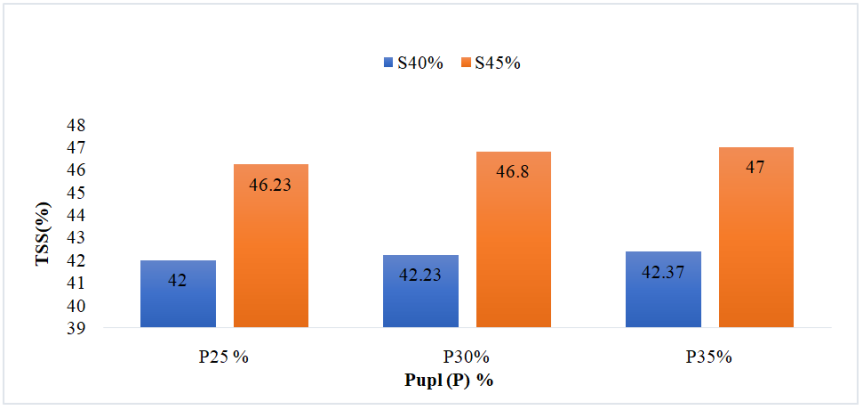

Fig. 3. Interaction effect of pulp(P) % and sugar(S) % on TSS of Early Grande variety of Peach.

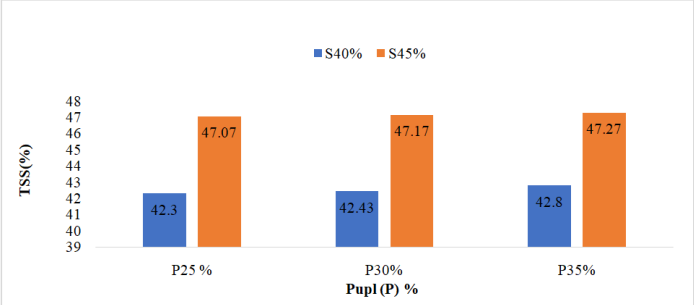

Fig. 4. Interaction effect of pulp(P) % and sugar(S) % on TSS of Shan-e-Punjab variety of Peach.

Titratable acidity(%). Data regarding effect of pulp and sugar on titratable acidity (%) of peach squash prepared from fruits of all three cultivars have been presented in Table 2. It is evident from the table that acidity ranged from 1.13 to 1.52. Titratable acidity increased with the increase in pulp and sugar level. The titratable acidity of all fruit squashes increased significantly but there were no significant differences observed between the cultivars. The maximum titratable acidity (1.52) was obtained by combination of 35% Pulp and 40% sugar concentrations in the squash of Shan-e-Punjab cultivar while it was observed minimum in the combination of 25% Pulp and 40% sugar concentrations irrespective of cultivars. Acidity was found to be increase by blending plum with apricot and pear pulp, where as it got decrease with apple juice and apple concentrate both during blending and after 6 months of storage period of time at ambient temperature (Bhardwaj, 2013). Acidity of RTS beverages prepared from grape: mango blend be verages decreased slightly with corresponding increase in Brix/acid ratio (Bhardwaj and Pandey 2011). During storage, the acidity of lime squash decreased (Papade *et al.,* 2015). This could be a result of the hydrolysis of polysaccharides, in which organic acid transforms into hexose sugar or complexes in the presence of metal ions.

Table 2: Effect of pulp and sugar levels on titratable acidity of squash in peach cultivars.

Pulp(%)	Florda Prince			Early Grande			Shan-e-Punjab		
	Sugars(%)			Sugars(%)			Sugars(%)		
	40	45	Means	40	45	Means	40	45	Means
25	1.13	1.28	1.21	1.21	1.45	1.33	1.13	1.17	1.15
30	1.26	1.35	1.31	1.27	1.30	1.29	1.20	1.27	1.24
35	1.37	1.44	1.41	1.43	1.47	1.45	1.52	1.43	1.48
Means	1.25	1.36		1.30	1.41		1.28	1.29	
Factors	**Pulp(P)**	**Sugar(S)**	**Interaction (P × S)**	**Pulp(P)**	**Sugar(S)**	**Interaction (P × S)**	**Pulp(P)**	**Sugar(S)**	**Interaction (P × S)**
C.D. at 5%	0.028	0.023	0.039	NS	NS	NS	0.165	NS	NS
SEm±	0.009	0.007	0.013	0.063	0.051	0.089	0.053	0.043	0.075

Ascorbic acid (mg/100g). It is evident from that as corbic acid increases with increase in pulp content irrespective of cultivars and ranged from 7.42 to 13.71 are presented in Fig. 5-7. In general, ascorbic acid content of squash prepared from Shan-e-Punjab cultivar was found higher while it was observed minimum in Florda Prince cultivar. The maximum ascorbic acid (13.71)was obtained by combination of 35% Pulp and45% sugar concentrations in Shan-e-Punjab cultivar followed by Early Grande (11.61). The interaction between ratio of pulp and sugar concentrations significantly influenced the ascorbic acid content of squash and the highest value was occurred with 35% pulp +45% sugar level while lowest ascorbic acid occurred with 25% pulp + 40% sugar level in all combinations. Extracted juice of cashew apple when blended with various proportions of sweet orange juice, that ascorbic acid content was decreased after mixing as compared to the juice of cashew apple alone (Anand *et al.,* 2014). Rapid decrease in ascorbic acid content in blends consisting of apple, banana orange after 3 hours of incubation at ambient temperature (Guimaraes *et al.,* 2013).

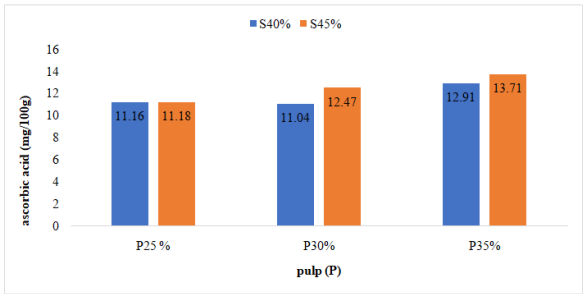

Fig. 5. Interaction effect of pulp(P) % and sugar(S) % on ascorbic acid of Florida Prince variety of Peach.

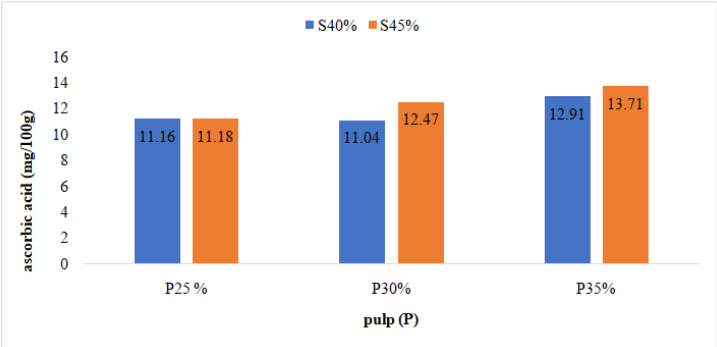

Fig. 6. Interaction effect of pulp(P) % and sugar(S) % on ascorbic acid of Early Grande variety of Peach.

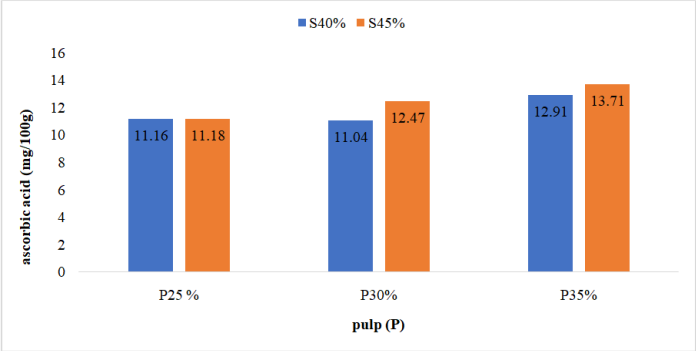

Fig. 7. Interaction effect of pulp(P) % and sugar(S) % on ascorbic acid of Shan-e-Punjab variety of Peach

Reducing sugars (%). Reducing sugars (%) of peach squash prepared from fruits of all three cultivars with varying levels of pulp and sugar proportions are presented in Table. 3. It was observed that the reducing sugar of peach squash increased with the increase in pulp and sugar concentrations and ranged from 4.13 to 4.77%. No significant difference in reducing sugar content was observed among the squash of all cultivars. The maximum reducing sugar (4.77) was obtained by combination of 35% Pulp and 45% sugar concentrations in Florda Prince cultivar while it was minimum in the combination of 25% pulp + 40% sugar level in all cultivars. Interaction between ratio of pulp and sugar concentrations significantly influenced the reducing sugar content of squash and the highest value was occurred with 35% pulp + 45% sugar level while lowest reducing sugar occurred with 25% pulp + 40% sugar level in all combinations. Gradual inversion of nonreducing sugars was likely the cause of the increase in reducing sugars of aonla syrup during storage (Barwal and Shrera 2009). Rise in reducing sugars may be the result of the hydrolysis-induced conversion of non-reducing sugar to reducing sugar (Papade *et al.,* 2015). Amount of reducing sugar in lemon, orange, and bael squash rose during storage (Relekar *et al.,* 2013).

Table 3: Effect of pulp and sugar levels on reducing sugars (%) of squash in peach cultivars.

	Florda Prince			Early Grand			Shan-e-Punjab		
	Sugars(%)			Sugars(%)			Sugars(%)		
Pulp(%)	40	45	Means	40	45	Means	40	45	Means
25	4.13	4.18	4.16	4.13	4.35	4.24	4.13	4.19	4.16
30	4.26	4.35	4.31	4.28	4.40	4.34	4.35	4.43	4.39
35	4.73	4.77	4.75	4.71	4.73	4.72	4.59	4.62	4.61
Means	4.37	4.43		4.37	4.49		4.36	4.41	
Factors	Pulp(P)	Sugar(S)	Interaction (P×S)	Pulp(P)	Sugar(S)	Interaction (P×S)	Pulp(P)	Sugar(S)	Interaction (P×S)
C.D. at 5%	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.003
SEm±	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001

Total sugars (%). Total sugars (%) of peach squash prepared from fruits of all three cultivars with varying levels of pulp and sugar proportions are presented in Table 4. It was observed that the total sugar of peach squash increased with the increase in pulp and sugar concentrations and ranged from 16.47 to 20.69%. Significant difference in total sugar content was observed among the squash of all cultivars. Total sugar content of squash prepared from Florda prince cultivar was found higher (20.69%) while it was observed minimum in Shan-e-Punjab cultivar (16.47%). The maximum total sugar (20.69) was obtained by

combination of 35% Pulp and 45% sugar concentrations in Florda Prince cultivar followed by Early Grande (19.93) while it was found minimum in Shan-e-Punjab cultivar (16.47%) with the combination of 25% Pulp and 40% sugar. The interaction between ratio of pulp and sugar concentrations significantly influenced the total sugar content of squash and the highest value was occurred with 35% pulp + 45%sugar level while lowest total sugar occurred with 25% pulp + 40% sugar level in all combinations. Total sugar increased during storage period which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides (Jothi *et al.,* 2014). Complex carbohydrate's partial hydrolysis may be the cause of changes in sugar concentration (Papade *et al.,* 2015). Hydrolysis must have been hastened by the atmosphere's high temperature and low humidity.

Table 4: Effect of pulp and sugar levels on total sugars (%) of squash in peach cultivars.

Pulp(%)	Florda Prince			Early Grand			Shan-e-Punjab		
	Sugars(%)			Sugars(%)			Sugars(%)		
	40	45	Means	40	45	Means	40	45	Means
25	17.50	17.83	17.67	17.42	18.04	17.73	16.47	16.49	16.48
30	18.28	18.79	18.54	18.53	19.65	19.09	16.83	16.98	16.91
35	19.91	20.69	20.30	19.85	19.93	19.89	17.31	17.81	17.56
Means	18.56	19.10		18.60	19.21		16.87	17.09	
Factors	**Pulp(P)**	**Sugar (S)**	**Interaction (P×S)**	**Pulp (P)**	**Sugar (S)**	**Interaction (P×S)**	**Pulp(P)**	**Sugar (S)**	**Interaction (P×S)**
C.D. at 5%	0.041	0.034	0.58	0.045	0.036	0.063	0.185	0.151	0.262
SEm±	0.013	0.011	0.019	0.014	0.012	0.020	0.059	0.048	0.084

Plate 1: Procurement of fruits.

Plate 2: Washing of fruits.

Plate 3: Peeling of fruits.

Plate 4: Cutting into pieces.

Plate 5: Boiling of fruit pieces.

Plate 6: Pulp extraction through pulper.

Plate 7: Peach squash and their diluted drink.

CONCLUSION

Evaluation of promising low chill peach cultivars for making of beverages could make growing of peaches viable in the low altitude areas. From the study, it may be concluded that peach cultivar Shan-e-Punjab and Florda Prince may be recommended for the preparation of squash having formulation of 35 per cent pulp, 40 per cent sugar and 1.0 per cent acid among the low chill cultivars of peach to satisfy consumer taste and preferences. The processing is simple and biochemical analysis indicates that peach is a good source of protein, minerals and energy. The nutritional value of peach squash is quite fulfilling according to health point of view.

FUTURE SCOPE

In future it has great opportunity to identifying the new cultivar to preparation of squashes and other post harvest product like jam, jelly, crush and syrup. The research work should also be done at molecular level to identifying the gene which improve the quality and shelf life of peach.

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Conflict of Interest. None.

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