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Sensory evaluation of kinnow powder

■ **Dhruv Juyal**

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Author for Correspondence :
Dhruv Juyal
Department of Processing and Food Engineering, Punjab Agricultural University,
Ludhiana (Punjab) India
Email: dhruvjuyal@gmail.com

■ **ABSTRACT :** The maximum values of correlation co-efficient between sensorially evaluated fresh juice and reconstituted juice were (0.28) for colour at 35:65 blend, (0.48) for flavour at 35:65 and 37.5:62.5 blend, (0.24) for consistency at 40:60 blend and (0.48) for overall acceptability at 35:65 blend.

■ **KEY WORDS :** Kinnow powder, Sensory evaluation, Reconstituted juice, Fresh kinnow juice, Flavour

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Citrus is one of the most important subtropical fruits in the world with total production of 115.651 million tonnes with India contributing 6.3 million tonnes (FAO, 2007). India is the second largest producer of fruits with a production of 93.7 MT from 6.45 Mha. In India, citrus is cultivated on 1.037 million hectares with an estimated production of 12.053 million tonnes (NHB, 2016).

Kinnow is a first generation hybrid of "King" and "Willow leaf" mandarins (citrus nobilis and citrus delicosa (Joshi *et al*., 1997). It has become an important variety in the state of Punjab, occupying a major part of the area under cultivation for fruit crops. The area under cultivation of kinnow is 49,356 ha with production of 11,40,312 MT (Anonymous, 2016). Kinnow is a variety of citrus cultivated extensively in North India (Sidhu *et al.,* 2016). Kinnow has many industrial and medicinal uses, has an attractive colour, distinctive flavour and is a rich source of vitamin- C, vitamin-B, β-carotene, calcium and phosphorus (Sogi and Singh, 2001).

Spray drying is one such modern technology that can help in conversion of fluid foods into powder form.

Bigueja (2012) revealed that the proportion of ingredient of spray dried passion fruit-guava powder affects the sensory attributes of the samples especially in terms of clarity, passion fruit aroma, passion fruit taste and in sourness. The sample with 70 per cent passion fruit extract and 30 per cent guava extract was most preferred being rank first among the three samples.

De Moura Neto *et al*. (2015) investigated that the conditions of spray drying of yellow mombin juice promoted significant differences between dehydrated juices and standard about the sensory characteristics and the attribute aroma was the only parameter showing a greater value for reconstituted juices than that of the standard. About reconstituted juices, one can observe that the increasing concentration of maltodextrin favored the reduction of all attributes.

Fegus *et al*. (2015) found out that higher degree of exposure to elevated temperature leads to lower flavour retention properties. Sensory panel perceived differences between different samples and in general the lowest ranking numbers were assigned to fruit powders process by spray drying technique.

Gbadegesin *et al*. (2017) found out that the result of sensory evaluation of the drinks produced from the samples of blended roselle and pineapple powders, in terms of colour, there was no significant difference ($p >$

0.05) in the samples. This showed that the addition of pineapple powder to the roselle powder at 15, 20 and 25 per cent did not affect the colour of the drinks. In terms of flavour, taste and overall acceptability, roselle sample containing 25 per cent pineapple had the highest sensory hedonic score and the preferences increased significantly ($p < 0.05$) with increase in the level of incorporation of pineapple powder to roselle powder.

Kapoor and Ranote (2016) found out that the overall acceptability scores were highest for pear juice containing 4 per cent *Jamun* powder from both freeze drying and hot air drying methods. Pear juice containing *Jamun* powder at higher levels was slightly astringent. Therefore, optimum sensory properties were established at 4 per cent level.

Kumar *et al.* (2012) studied that the dried powders were subjected to sensory evaluation in the form of juice. To prepare juice amount of powder was standardized. To 100ml of juice preparation 7.5g of powder was acceptable in all the sensory attributes. The powders were kept for storage for a period of seven days. Powders were subjected to sensory evaluation in the form of juice before and after storage. The samples were also stored in two different temperatures that is room temperature and refrigeration at 4-6^{0}C. The sensory evaluation attributes revealed that the freeze dried sample stored at refrigerator scored equal to fresh juice in all the attributes. The sensory scores at the control (fresh fruit juice) and freeze dried (refrigerator sample) after storage for colour was 4.1, 4.00, taste was 4.2, 3.8, flavour was 4.2, 3.9, texture 4.2, 4.0 and overall acceptability was 4.2, 3.8, respectively.

Limbaga *et al.* (2014) found out that sensory evaluation of bilimbi powder showed that the dilution used was too sour. The acceptability was in the range of dislike slightly to like moderately in the 9-point Hedonic scale.

Mahendran (2010) studied that freeze drying produced the best quality guava powder in terms of colour and flavour. Spray dried product had bright and attractive colour in comparison to the darker tunnel dried product. The latter was rated poorly in the taste panel assessments possessing a distinct off-flavour. Maltodextrin proved to be the effective additive, producing a product of acceptable flavor. The spray dried, reconstituted juice was slightly lacking in flavour compared to freshly prepared juice but was preferred to tunnel dried material. This assessment reflects the heat damage indicated by the chemical analyses, consequently the poor quality of the product does not recommend the application of tunnel drying.

Rahel *et al.* (2015) studied the results on sensory evaluation of the guava pulps and powders which showed that among the treatments the overall acceptability of (3% calcium chloride) was found higher than the other treatments. Sensory analysis showed that the use of calcium improved the textural characteristic of the guava powder during storage.

Sharma *et al.* (2013) particle size had a significant effect on sensory parameters *viz*., colour/appearance, flavour, mouth feel, taste and overall acceptability. Mango powder with particle size in the range of 258.01 to 264.60 µm, *i.e.* the one which passed through the 60 mesh sieve, was found to be most acceptable with respect to sensory characteristics. This finding can be exploited for various commercial applications where powder quality is dependent upon particle size and has foremost priority for the end users.

Sidhu *et al.* (2016) found out that the mean score for overall acceptability decreased from 8.3 to 7.5 in all packaging material stored under ambient conditions. The maximum mean score for kinnow peel powder was observed in laminate bag (7.3) stored under refrigerated conditions. The statistical analysis of data showed that packaging material, interaction of packaging material and storage conditions did not have a significant effect on sensory score.

Swami *et al.* (2016) the statistical analysis of sensory data was carried out in MS excel using analysis of variance (ANOVA). The results of ANOVA show that there is no difference in the colour, flavour, texture and overall acceptability of jackfruit bulb powder. The treatment at sugar solution of 70°B secure maximum score for colour, flavour, texture and overall acceptability. The jackfruit bulbs osmotically dehydrated at 70 °B sugar solution and dried at 60°C in tray dryer results in to good quality jackfruit bulb powder. The data on sensory evaluation of Jackfruit bulb powder stored in different packaging materials *i.e*. Pet Bottles, transparent polypouch and Met Pet Polypack observed at varied durations *i.e.* 3, 6, 9 and 12 months, respectively. Results drawn from a consumer acceptance test indicate that the jackfruit bulb powder packed in met pet poly pack was more attractive and preferred because it proved to

be better in terms of color, flavor, texture and overall acceptability.

The present study was conducted on sensory properties of reconstituted spray dried kinnow powder and fresh kinnow juice so as to obtain the correlation between sensorially evaluated fresh kinnow juice and reconstituted spray dried kinnow powder.

METHODOLOGY

The experiments to produce kinnow powder from kinnow juice were carried out at three inlet and feed temperatures at three different blends (35:65, 37.5:62.5, 40:60) of kinnow juice with malto-dextrin and with (40:10:50) malto-dextrin and sucrose with juice using spray drying technique.

Sensory evaluation of reconstituted juice and Kinnow juice :

Sensory evaluation :

The manufactured powders were mixed with water in the ratio of 1: 5 (1 part of powder to 5 parts of water) (specified by Foods and Inns Limited, Mumbai for spray dried lemon juice powder) for the three blends and a dilution factor of 1:3 (1 part of powder to 3 parts of water) was applied to the blend of 40:10:50 (M.D.:sucrose:juice) and reconstituted juice was sensorially evaluated by a semi-trained panel of 8 judges on a hedonic scale (Sensory Science, 2006).

The parameters evaluated were:

– Colour and appearance

– Flavour

– Consistency

– Overall acceptability.

Along with this, fresh kinnow juice was also sensorially evaluated to study the correlation with reconstituted juice. Flavour of kinnow juice was evaluated on the basis of a 9-point category scale (1,2,3 = low quality; 4,5,6 = acceptable quality and 7,8,9 = high quality) coined by (Marcilla *et al.*, 2006) indicating orange like-flavour.

Statistical analysis :

It was done by applying the Spearman's rank correlation co-efficient test for determining the 'r' correlation co-efficient between sensorially evaluated reconstituted juice and fresh kinnow juice and two way and one way ANOVA for testing the significance using G-STAT SOFTWARE 2004 (Cheema and Sidhu, 2004). The significance of 'r' was tested by using the significance of correlation co-efficient (p=0) with (n-2) d.f.

$$t = r/\ sqrt(1- r^2)\ *sqrt(n-2)$$

Table A : Proforma for sensory evaluation

Name of product : Date :

Name of panelist :

Sr.No.	Sample code	Appearance	Flavour	Body and texture	Overall acceptability	Remarks
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

Scores :

1. Disliked extremely	4. Disliked slightly	7.Liked moderately
2. Disliked very much	5. Neither liked nor disliked	8. Liked very much
3. Disliked moderately	6. Liked slightly	9. Liked extremely

Signature

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Sensory evaluation of kinnow juice and reconstituted juice:

Scores were calculated by taking average of all the 8 evaluations. Applied blend proportions had significant effect on flavour of reconstituted juice (Table 1).

The results of sensory evaluation of reconstituted juice and fresh juice were analysed to study the co-efficient of correlation between them by Spearman's rank correlation co-efficient method.

A positive very low correlation co-efficient to low correlation co-efficient (0.047, 0.19 and 0.28), Table 2 exists for colour for three blends, whereas for flavour a medium positive correlation co-efficient (0.43,0.48,0.48) Table 2 exists for three blends, for consistency a low correlation co-efficient (0.19,0.21,0.24) Table 2 exists for three blends and for overall acceptability a low to medium correlation co-efficient (0.19,0.43,0.48) Table 2 exists for three blends.

The powder produced at M.D. : sucrose : juice blend of 40:10:50 represented the value of correlation co-efficient for colour, flavour, consistency and overall acceptability as 0.60, 0.29, 0.24 and 0.19, respectively.

Conclusion :

Since a dilution factor of 1:5 (1 part of powder to 5 parts of water) was applied to first three blends, therefore, dilution factor has to be reduced to 1:3 (1 part of powder to 3 parts of water) so as to enhance the correlation co-efficient between fresh and reconstituted juice for different sensory quality parameters. At the blend of 40:10:50 (M.D.:sucrose:juice), a dilution factor of 1:3 (1 part of powder to 3 parts of water) was applied which made reconstituted juice more sweet, therefore, a dilution factor of 1:4 (1 part of powder to 4 parts of water) would be better so as to obtain the high correlation co-efficient for all the sensory quality parameters.

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Table 1 : Effect of blend proportions on sensory quality of kinnow juice

Parameters	Colour	Flavour	Consistency	Overall acceptabiity
Blends				
35:65	7	6[a]	6.625	6.125
37.5:62.5	7	6.625[b]	6.75	7.375
40:60	7.125	6.375[c]	6.5	6.375
40:10:50	7	6.75[d]	6.625	6.5
C.D. (P=0.05)	NS	.068	NS	NS
Fresh juice values	7.875	7.75	7.875	7.75

Within the table, mean values bearing at least one common superscript are statistically similar (P<0.05),Values indicated are mean values of 8 replications
NS= Non-significant

Table 2 : Correlation co-efficient (r) between reconstituted juice and fresh juice for different sensory quality parameters

Parameters	Colour	Flavour	Consistency	Overall acceptability
Blends used = M.D.: juice				
35:65	**0.28**	**0.48**	0.19	**0.48**
37.5:62.5	0.19	**0.48**	0 .21	**0.43**
40:60	0.047	**0.43**	0.24	0.19
40:10:50 (M.D.: sucrose: juice)	**0.60**	**0.29**	0.24	0.19

Bold values show that 'r' is statistically significant

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