Plant Archives Vol. 25, No. 1, 2025 pp. 2714-2718 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.391

EFFECT OF INCORPORATION OF LEMONGRASS ON QUALITY CHARACTERISTICS OF KIWI BASED NECTAR

Abhay Bhagat, Monika Sood*, Julie D. Bandral, Neeraj Gupta, Kamaldeep Kour and Mehnaza Bashir

Division of Post-Harvest Management, Faculty of Horticulture & Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu, India.

*Corresponding author E-mail : monikasoodfst@gmail.com

(Date of Receiving-13-01-2025; Date of Acceptance-29-03-2025)

ABSTRACT

Kiwi fruit is regarded as an antioxidant rich fruit that reduces oxidative damage and shows positive effect on cardiovascular health, inhibits the platelet aggregation; improve the digestion by improving the gut microflora. However, it is perishable in nature and have a relatively short shelf life. Therefore, the present investigation was undertaken to evaluate the nutritive and sensory characteristics of kiwi and lemongrass blended nectar, during 90 days of storage under ambient conditions. Seven treatments were prepared using varied concentrations of T_1 (100:00:: Kiwi pulp: Lemongrass extract), T_2 (97:03:: Kiwi pulp: Lemongrass extract),T_3 (94:06:: Kiwi pulp: Lemongrass extract), T_4 (91:09:: Kiwi pulp: Lemongrass extract), T_5 (88:12:: Kiwi pulp: Lemongrass extract), T_6 (85:15:: Kiwi pulp: Lemongrass extract) and T_7 (82:18:: Kiwi pulp: Lemongrass extract) to form nutritious and delightful nectar. The formulated nectar was packed in glass bottles and its storability was studied for 90 days under ambient conditions. The quality analysis of kiwi-lemongrass nectar revealed that maximum mean TSS 15.43°B, titratable acidity 0.363%, reducing sugar 9.94%, total sugar 12.66% and ascorbic acid 48.88 mg per 100 ml were recorded in T_1. However, treatment T_7 recorded highest phosphorus content (57.89 mg/100ml). However, sensory evaluation revealed that nectar blended with 88% kiwi pulp along with 12% lemongrass extract was most acceptable.

Key words : Kiwi, Lemongrass, Nectar, Total sugars, Ascorbic acid, Sensory evaluation.

Introduction

Fruits are an essential part of balanced diet acting as a major source of carbohydrates, minerals, vitamins, dietary fibers and other bioactive components. They are good source of vitamin C, vitamin A, thiamine, riboflavin, niacin, pantothenic acid and folic acid (Samtiya *et al*., 2021). They are the powerhouse of essential nutrients that helps the human body be fit, rejuvenate and free of diseases.

The kiwi fruit (*Actinidia deliciosa*) is a member of the genus *Actinidia* and family *Actinidiaceae* and are also known as Macaque peach and Chinese gooseberry. It is among the fruits that are extensively commercialized internationally. In India, kiwi fruit occupies 5,000-hectare area with 16,000 MT production (DAFW, 2023). Kiwi is regarded as an antioxidant rich fruit that reduces oxidative damage and shows positive effect on cardiovascular health, inhibits the platelet aggregation; improve the digestion by improving the gut microflora (Freese, 2006). It has gained popularity among consumers because of the high nutritional value and favourable aroma. However, kiwi being a climacteric fruit, has a short storage life due to rapid softening and is highly perishable during storage and transportation (Ma *et al*., 2019).

Lemongrass (*Cymbopogon citratus*) is a tall, aromatic grass that is a member of the Graminacae (*Poaceae*) family. Lemongrass leaves, stem and roots are abundant source of essential vitamins such as vitamin B_5, vitamin B_6 and vitamin B_1. Fresh herb contains small amounts of antioxidant vitamins such as vitamin C and vitamin A (Bochare *et al*., 2020). Lemongrass contains several bioactive-compounds in its decoction, infusion and essential oil extracts. Antioxidant, anti-inflammatory, anti-

bacterial, anti-obesity, antinociceptive, anxiolytic and antihypertensive supports pharmacological claims (Olorunnisola *et al.*, 2012). Nowadays, people tend to consume more functional foods and supplements on a daily basis as a result of growing dietary awareness as well as demand for healthy foods. Beverages being rich source of essential minerals, vitamins and other nutritive factors are liked and appreciated by people of distinct ages and are acceptable on all occasions. Nectar is one of the refreshing beverages which is enriched with vitamins and minerals (Bal *et al*., 2014). Fruit nectar should have 20 per cent fruit juice, 15 per cent TSS and 1.5 per cent citric acid according to FSSAI guidelines (Majumder *et al*., 2017).

Materials and Methods

Kiwi was purchased from local market of Jammu and lemongrass was procured from IIIM Farm, Jammu. The raw materials were taken to the Food Processing and Training Centre in the Division of Post-Harvest Management, SKUAST-Jammu for further processing. Other materials used for nectar preparation *viz.*; sugar and citric acid were also procured from local market of Jammu.

Extraction of pulp/Extract

Fresh kiwi fruits and lemongrass were washed under running water to remove all impurities. Kiwi fruits were then peeled, cut and pulp was extracted using hot break pulping method (Lal *et al.*, 2002). The extracted pulp was used for further processing. The lemongrass juice was extracted with a ratio of lemongrass to water 1:4 (w/v) and boiled in reflecting condenser for 30 min., then the mixture was filtered using muslin cloth (Assous *et al*., 2013).

Formulation of Nectar

The kiwi pulp and lemongrass extract were blended in different ratios (100:00, 97:03, 94:6, 91:9, 88:12, 85:15, 82:18) for preparation of kiwi-lemongrass blended nectar. The kiwi-lemongrass blended nectar was prepared as per the procedure given by Bochare *et al*. (2020) with slight modifications. Total soluble solids and acidity of the nectar was adjusted at 15°Brix and 0.3 per cent by using sugar and citric acid wherever necessary, followed by heating at 85°C for 10 minutes. Immediately after pasteurization, the nectar was filled into pre-sterilized glass bottles of 250 ml capacity keeping 1.5-2 cm head space. The filled bottles were sealed airtight using crown caps with the help of crown corking machine. Then the bottles were pasteurized at 85°C for 15 minutes, cooled to room temperature and labeled.

Quality analysis

Total soluble solid (TSS) was determined by using hand refractometer (0-32°B) and the results were expressed as degree brix (°B) according to standard procedure given by Ranganna (2014). Titratable acidity was estimated by titrating a known quantity of sample (10 ml) against standard solution of 0.1 N sodium hydroxide to a light pink colour using few drops of phenolphthalein as an indicator. The results were expressed as per cent citric acid (AOAC, 2012). Sugars were determined as per the method of Ranganna (2014). Measured sample of (20 ml) was taken in volumetric flask of 250 ml to which 100 ml distilled water was added and neutralized with 40 per cent NaOH using phenolphthalein as an indicator till appearance of pink colour was observed in the solution.

Ascorbic acid was estimated by method as described by Ranganna (2014) using 2, 6 dichlorophenol indophenol as dye. The mineral contents were determined after the ash content determination. The ash residue of each formulation was digested with perchloric acid and nitric acid (1:4) solution (AOAC, 2012). The results obtained were statistically analyzed using Factorial completely randomized design (CRD) for interpretation of results through analysis of variance using OPSTAT software.

Results and Discussion

The mean TSS among control and final treatment with 18 percent lemongrass extract showed a decrease of 1.94 per cent (Table 1). The TSS of blended nectar decreased with the addition of lemongrass extract which might be due to lower concentration of TSS in lemongrass. With the progression in storage period, significant increase in TSS was observed from 15.00 ^{0}B to 15.48 ^{0}B, in kiwi-lemongrass blended nectar. The increase in TSS might be due to conversion of polysaccharides into soluble sugar and formation of water-soluble pectin from protopectin as reported by Bal *et al*. (2014).

The titratable acidity (Table 1) showed a decrease of 14 per cent among control and treatments. The titratable acidity increased with treatments which might be due to higher titratable acidity in kiwi pulp as compared to lemongrass juice. During storage period of 90 days the mean value for titratable acidity increased from 0.300 to 0.358 per cent. The increase in titratable acidity might be due to rapid conversion of protein into amino acid (Singh *et al*., 2018).

Among control and treatments, 8.87 and 7.01 per cent decrease was recorded in reducing sugar and total sugar content of the nectar, with increase in lemongrass nectar percentage (Table 2). Decrease in sugar of

Table 1 : Effect of treatment and storage on total soluble solids (°Brix) and titratable acidity (%) of kiwi-lemongrass blended nectar.

Treatments	TSS				Mean (treatments)	Titratable acidity				Mean (treatments)
	Storage periods (days)					Storage periods (days)				
	0	30	60	90		0	30	60	90	
T_1 (100:00:KP:LG)	15.00	15.43	15.60	15.71	15.43	0.300	0.370	0.386	0.398	0.363
T_2 (97:03:: KP:LG)	15.00	15.38	15.55	15.62	15.38	0.300	0.359	0.371	0.382	0.352
T_3 (94: 06:: KP:LG)	15.00	15.32	15.45	15.56	15.33	0.300	0.346	0.360	0.369	0.343
T_4 (91: 09::KP:LG)	15.00	15.26	15.39	15.47	15.28	0.300	0.332	0.348	0.356	0.334
T_5 (88:12::KP:LG)	15.00	15.18	15.30	15.41	15.22	0.300	0.320	0.332	0.347	0.324
T_6 (85:15::KP:LG)	15.00	15.12	15.22	15.34	15.17	0.300	0.311	0.323	0.334	0.317
T_7 (82:18:: KP:LG)	15.00	15.07	15.19	15.28	15.13	0.300	0.304	0.317	0.324	0.311
Mean (Storage)	15.00	15.25	15.38	15.48		0.300	0.334	0.348	0.358	

Effects	C.D ($p \leq 0.05$)
Treatments	0.04
Storage	0.03
Treatment × Storage	0.08

KP: Kiwi pulp
LG: Lemongrass extract

Effects	C.D ($p \leq 0.05$)
Treatments	0.028
Storage	0.016
Treatment × Storage	0.045

KP: Kiwi pulp
LG: Lemongrass extract

Table 2 : Effect of treatment and storage on reducing sugars (%) and total sugars (%) of kiwi- lemongrass blended nectar.

Treatments	Reducing sugars (%)				Mean (treatments)	Total sugars (%)				Mean (treatments)
	Storage periods (days)					Storage periods (days)				
	0	30	60	90		0	30	60	90	
T_1 (100: 00::KP:LG)	9.60	9.89	10.08	10.22	9.94	12.11	12.70	12.86	12.99	12.66
T_2 (97:03:: KP:LG)	9.48	9.71	9.92	10.16	9.81	12.04	12.63	12.74	12.80	12.55
T_3 (94: 06::) KP:LG)	9.37	9.50	9.68	9.80	9.58	11.91	12.36	12.59	12.67	12.38
T_4 (91: 09:: KP:LG)	9.24	9.49	9.58	9.67	9.49	11.87	12.29	12.42	12.54	12.28
T_5 (88:12:: KP:LG)	9.10	9.31	9.50	9.63	9.38	11.72	12.17	12.31	12.48	12.17
T_6 (85:15:: KP:LG)	9.01	9.19	9.34	9.46	9.25	11.58	12.03	12.25	12.34	12.05
T_7 (82:18:: KP:LG)	8.88	9.09	2.21	9.35	9.13	11.40	11.84	11.97	12.11	11.83
Mean (Storage)	9.24	9.45	9.61	9.75		11.80	12.28	12.44	12.56	

Effects	C.D ($p \leq 0.05$)
Blends	0.03
Storage	0.03
Blends × Storage	0.07

KP: Kiwi pulp
LG: Lemongrass extract

Effects	C.D ($p \leq 0.05$)
Blends	0.04
Storage	0.03
Blends × Storage	0.07

KP: Kiwi pulp
LG: Lemongrass extract

blended nectar might be due to the lower concentration of reducing sugar in the lemongrass. During storage, reducing sugar and total sugar content showed an increase of 5.51 and 6.44 per cent which might possibly be due to hydrolysis of polysaccharides like starch, pectin etc. into simple sugars. Kumar *et al*. (2018) also reported similar increase in total sugar in nectar prepared from guava-jamun blended RTS and mango nectar. Table 3 illustrates the minerals present in the blended nectar. Among treatments, mean potassium and phosphorus content varied from 205.93 to 181.44 mg per 100 ml and 51.31 to 57.89 mg per 100 ml, respectively. The incorporation of lemongrass in the blended nectar decreased the potassium content whereas, phosphorus

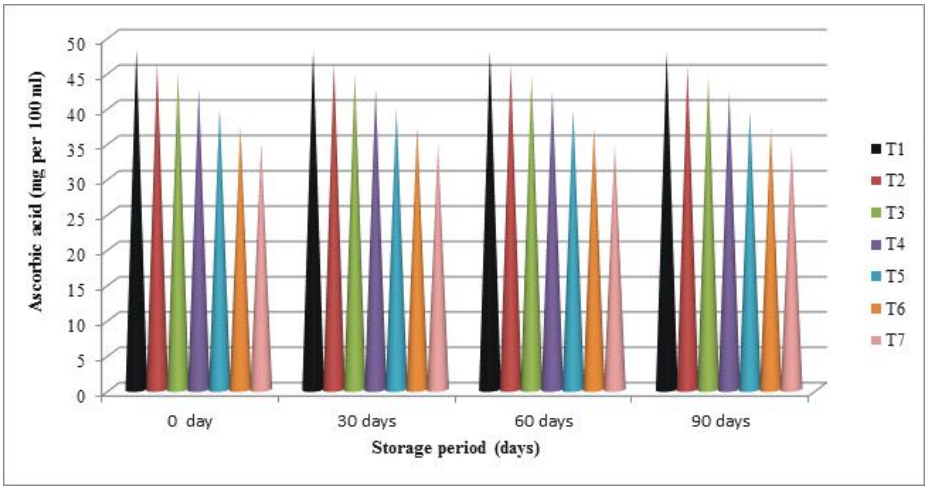

Fig. 1 : Effect of treatment and storage on ascorbic acid content (mg/100 ml) of kiwi-lemongrass blended nectar.

Table 3 : Effect of treatment and storage on Potassium (mg/100g) and Phosphorus (mg/100g) of kiwi-lemongrass blended nectar.

Treatments	Potassium (mg/100 ml)				Mean (treatments)	Phosphorus (mg/100 ml)				Mean (treatments)
	Storage periods (days)					Storage periods (days)				
	0	30	60	90		0	30	60	90	
T_1 (100: 00::KP:LG)	206.10	205.98	205.89	205.77	205.93	51.45	51.38	51.29	51.14	51.31
T_2 (97:03:: KP:LG)	201.64	201.53	201.44	201.35	201.49	52.64	52.56	52.49	52.39	52.52
T_3 (94: 06::) KP:LG)	197.19	197.11	197.04	196.90	197.06	53.13	52.97	52.82	52.73	52.91
T_4 (91: 09:: KP:LG)	193.33	193.24	193.16	193.07	193.19	54.59	54.50	54.41	54.32	54.45
T_5 (88:12:: KP:LG)	189.12	189.05	188.94	188.86	188.06	55.64	55.52	55.44	55.35	55.48
T_6 (85:15:: KP:LG)	185.26	185.12	185.00	184.89	185.06	56.88	56.79	56.68	56.61	56.74
T_7 (82:18:: KP:LG)	181.63	181.50	181.40	181.28	181.44	58.01	57.91	57.86	57.77	57.89
Mean (Storage)	193.46	193.35	193.26	193.15		54.62	54.51	54.42	54.33	
Effects			C.D ($p \leq 0.05$)			Effects			C.D ($p \leq 0.05$)	
Blends			0.03			Blends			0.04	
Storage			0.03			Storage			0.03	
Blends × Storage			0.07			Blends × Storage			0.07	
KP: Kiwi pulp						KP: Kiwi pulp				
LG: Lemongrass extract						LG: Lemongrass extract				

showed an increasing trend which might be due to the availability of minerals in lemongrass.

The mean ascorbic acid (Fig. 1) of kiwi lemongrass blended nectar showed a decrease of 28.35 per cent among treatments. Treatment T_1 (100:00:: Kiwi pulp: Lemongrass extract) showed maximum ascorbic acid of 48.88 mg per 100 ml. Mean ascorbic acid content decreased from 42.00 to 41.77 mg per 100 ml during storage period of 90 days. The decline in ascorbic acid might be due to oxidation of ascorbic acid into dehydro-ascorbic acid followed by further degradation (Ahmad *et al*., 2016). These findings are in accordance with Kumar *et al*. (2018), who reported similar decrease in ascorbic acid content in mango nectar during 180 days of storage period. The maximum mean overall acceptability score of 7.90 was recorded in treatment T_5 (88:12 :: Kiwi pulp : Lemongrass extract) however, T_7 (82:18 :: Kiwi pulp : Lemongrass extract) scored least overall acceptability score of 7.14 (Fig. 2). Nectar incorporated with lemongrass extract was acceptable upto certain limit. Similar findings have been reported by Bochare *et al*. (2020) in kiwi fruit RTS beverage incorporated with herbs. With the progression in storage period of blended nectar, significant decrease in overall acceptability score was observed from 7.86 to 7.25. The significant reduction in overall acceptability score of blended nectar might be due to the loss in appearance and flavour compounds of the product during their storage

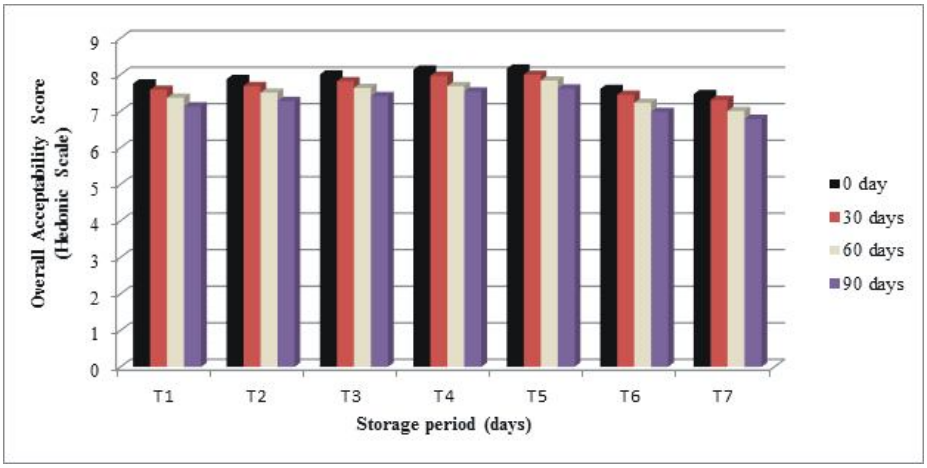

Fig. 2 : Effect of treatment and storage on overall acceptability of kiwi-lemongrass blended nectar.

(Hamid *et al.*, 2017). The decrease in acceptability scores of nectar during storage might also be owing to oxidative reaction which deteriorated the scores for colour, flavour as well as taste which further resulted in deterioration of overall acceptability scores (Rashid *et al.*, 2018).

Conclusion

Currently fruit beverages are gaining more popularity when compared to chemical drinks, due to their taste, flavour, appealing colour and higher nutritive value. The blended nectar showed enhanced nutritional and sensory characteristics in comparison to control. The kiwi nectar incorporated with 12% lemongrass extract was highly acceptable. The study concluded that the kiwi lemongrass blended nectar possibly satisfies consumer's taste and was safe for consumption up to 90 days of storage period.

References

Ahmad, T., Raj D., Senapati A.K., Tandel Y.N., Tak M.K. and Kumar V. (2016). Fruit nectar as a refreshing beverage an overall review. *J. Plant Develop. Sci.*, **8(7)**, 321-328.

AOAC (2012). *Official Methods of Analysis*. 19th edition. Association of Official Analytical Chemists, Washington, D. C.

Assous, M.T., EL-Waseif K.H. and Gado G.B. (2013). Production and evaluation of non traditional products from lemon grass. *Egyptian J. Agricult. Res.*, **91**, 271-283.

Bal, L.M., Ahmad T., Senapati A.K. and Pandit P.S. (2014). Evaluation of quality attributes during storage of guava nectar cv. Lalit from different pulp and TSS ratio. *J. Food Processing and Technology*, **5**, 329-334.

Bochare, S.S., Kshirsagar R.B. and Bogha T.T. (2020). Studies on development of kiwi fruit RTS beverage incorporated with lemongrass. *J. Pharmacog. Phytochem.*, **9**, 291-296.

DAFW (2023). Department of Agriculture and Farmers Welfare, Government of India, India. Available at ttps:// agricoop.nic.in/en/StatHortEst. Acessed on 28 November, 2024.

Freese, R. (2006). Markers of oxidative DNA damage in human interventions with fruit and berries. *Nutrition and Cancer*, **54**, 143-147.

Hamid, H., Thakur N.S., Kumar P. and Thakur A. (2017). Studies on preparation and preservation of ready-to-serve (RTS) beverage from underutilized mulberry (*Morus alba* L.) fruits and its quality evaluation during storage. *Int. J. Curr. Microbiol. Appl. Sci.*, **6**, 1067-1079.

Kumar, S., Godara R.K., Kumar S. and Jhamb R. (2018). Storage studies on quality parameters in nectar prepared from different cultivars of mango. *Int. J. Curr. Microbiol. Appl. Sci.*, **7**, 718-724.

Lal, B.B., Barwal V.S. and Sharma R. (2002). Use of sorbitol for the preparation of plum seasoned squash. *J. Food Sci. Technol.*, **39**, 413-417.

Ma, T., Lan T., Geng T., Ju Y., Cheng G., Que Z., Gao G., Fang Y. and Sun X. (2019). Nutritional properties and biological activities of kiwifruit (*Actinidia*) and kiwifruit products under simulated gastrointestinal in vitro digestion. *Food Nutr. Res.*, **8**, 63-79.

Majumder, S., Kumar P., Seelam B.S. and Peter S. (2017). Development of herbal nectar prepared from a blend of bottle gourd, mint and lime. *The Pharma Innov. J.*, **6**, 260-263.

Olorunnisola, S.K., Asiyanbi H.T., Hammed A.M. and Simsek S. (2012). Biological properties of lemongrass: An overview. *Int. Food Res. J.*, **21**, 455-462.

Ranganna, S. (2014). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (2nd ed.), Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Rashid, R., Bhat A., Dayal A., Sood M. and Sharma S. (2018). Studies on storage stability of guava RTS. *The Pharma Innov. J.*, **7**, 230-233.

Samtiya, M., Aluko R.E., Dhewa T. and Moreno-Rojas J.M. (2021). Potential health benefits of plant food-derived bioactive components: An overview. *Foods*, **10**, 828-839.

Singh, P.P., Tripathi A.D., Rai D.C., Kumar N. and Singh U.P. (2018). To study the shelf life of aloe vera fortified mango RTS with different time and temperature combinations on its organoleptic and functional properties. *The Pharma Innov. J.*, **7**, 91-97.