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Effect of varying pulp levels and TSS concentrations on the physicochemical characteristics of guava juice (cv. Taiwan Pink)

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Abstract

The present investigation was carried out to study the effect of varying pulp levels (7%, 10%, 12%, and 15%) and total soluble solids (TSS: 13°, 15°, and 18°Brix) concentrations on the physicochemical characteristics of guava juice (cv. Taiwan Pink) during storage up to 60 days at Post Harvest and Value Addition Laboratory, Mewar University Gangrar, Chittorgarh (Rajasthan) during February to May 2024-25. The results revealed that both pulp concentration and TSS levels had a significant influence on the quality parameters, including TSS, ascorbic acid, titratable acidity, and total sugar content. A gradual decline in TSS was observed across all treatments during storage, with higher initial TSS levels (18°Brix) maintaining significantly higher TSS values throughout the storage period. Ascorbic acid content also declined steadily but was better retained in treatments with higher pulp levels (12–15%) and higher TSS (18°Brix), indicating improved vitamin C stability. Titratable acidity showed a slight increase over storage, with higher pulp and TSS combinations contributing to better flavor retention and product stability. Similarly, total sugar content decreased marginally during storage, with the combination of 15% pulp and 18°Brix TSS recording the highest retention of sweetness and overall acceptability.

Keywords: Guava, Pulp concentration, total soluble solids, ascorbic acid and titratable acidity

Introduction

Guava (*Psidium guajava* L.) is a tropical fruit prized for its high nutritional value, especially its rich vitamin C, fiber, and antioxidant content (Sridhar *et al.*, 2017 and Kalsi *et al.*, 2023) [13, 5]. Among its cultivars, Taiwan Pink is particularly popular due to its attractive pink flesh and sweet-tangy flavour, making it ideal for juice production (Kalsi *et al.*, 2023) [5]. The growing consumer demand for healthy, natural fruit-based beverages has further increased the importance of guava juice as a functional drink with potential health benefits such as antioxidant, anti-inflammatory, and cholesterol-lowering effects (Moussa and El-Gendy, 2019 and Nasef *et al.*, 2020) [8, 9]. Processing and preserving guava juice, however, pose challenges in maintaining its key nutrients like vitamin C and sensory qualities such as taste, color, and texture during storage (Afifah and Agustini, 2024) [1]. Recent studies highlight innovative methods like thermosonication and the use of natural additives to enhance shelf life and nutrient retention (Kalsi *et al.*, 2023; Rahman *et al.*, 2020) [13, 10]. Moreover, juice quality parameters such as Total Soluble Solids (TSS) and pulp concentration play a crucial role in determining the final product's sensory appeal, biochemical stability, and consumer acceptability (Kaur *et al.*, 2019) [6]. Understanding the effects of TSS and pulp levels on the storage behavior of guava juice is therefore essential for developing high-quality, nutritious, and marketable guava beverages.

Materials and Methods

A lab experiment was conducted during February to May of 2024-25 at Post Harvest and Value Addition Laboratory, Department of Agriculture (Horticulture) Fruit Science, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). The experiment was laid out in FCRD (Factorial Completely Randomized Design) with two factors. The method for biochemical properties analysis is followed standard method of

particular parameters at different duration like 0, 30 and 60 days of storage. The data were analyzed by appropriate statistical method.

Results and Discussion

The results of the present investigation revealed that both pulp levels and total soluble solids (TSS) concentrations significantly influenced the physicochemical characteristics of guava juice (cv. Taiwan Pink) during storage up to 60 days.

Total Soluble Solids (°Brix)

The data presented in Table 1 illustrate that an overall gradual decline in TSS was observed across all treatments during storage. Initially, TSS ranged from 13.0°Brix to 18.0°Brix across treatments. After 60 days, values ranged from 12.3°Brix to 17.5°Brix. Treatments with higher initial TSS levels (18°Brix) consistently recorded higher TSS retention throughout storage, especially when combined with 12% pulp, indicating that both factors played a significant role in maintaining the sweetness and consistency of the juice over time. The present investigation are close agreement with findings of Sarker *et al.*, (2009) [11], Singh *et al.*, (2020) [12] and Kumar *et al.*, (2019) [7].

Ascorbic acid (Mg/100 g)

The data presented in Table 2 illustrate that the ascorbic acid content also showed a steady decline during storage, with values decreasing from 185–205 mg/100g at 0 days to 157–177 mg/100g by 60 days. However, guava juice with higher pulp concentrations (particularly 15%) and higher TSS levels (18°Brix) retained significantly higher vitamin C

levels compared to other combinations. This demonstrates the positive effect of higher pulp and TSS in preserving this key nutrient. The present investigation are agreement with findings of Chauhan and Verma, (2020) [4], Yadav *et al.*, (2019) [15], Kumar *et al.*, (2019) [7] and Yadav *et al.*, (2014) [14].

Acidity (%)

The data in Table 3 revealed that the effect of different pulp levels and TSS concentrations on the titratable acidity (%) of guava juice over 0, 30, and 60 days of storage. Acidity increased slightly as storage progressed. Initially ranging between 0.35% and 0.39%, acidity increased to 0.39%–0.44% by 60 days. Treatments with higher pulp levels (12%–15%) and higher TSS maintained slightly higher acidity, which contributes to flavor stability and helps maintain product quality during storage. The present investigation are agreement with findings of Sarker *et al.*, (2009) [11], Kumar *et al.*, (2019) [7] and Bhattacharya and Saha (2016) [3].

Total sugar (%)

The data was presented in table 4 revealed that the total sugar content ranged from 11.5% to 15.2% initially and decreased slightly over storage, with final values between 11.3% and 14.8% at 60 days. Treatments combining 15% pulp with 18°Brix TSS retained the highest sugar content, indicating that higher pulp and TSS levels are beneficial for maintaining sweetness and consumer acceptability. The present investigation are agreement with findings of AOAC, (2005) [2], Sarker *et al.*, (2009) [11] and Kumar *et al.*, (2019) [7].

Table 1: The effect of different levels of pulp and TSS concentration on total soluble solids (°Brix) of Guava juice

Storage period	Total Soluble Solids (°Brix)														
	0 Days					30 Days					60 Days				
	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean
B1 (13 °Brix)	13.0	15.0	18.0	13.0	14.8	12.8	14.8	17.7	12.7	14.5	12.6	14.5	17.5	12.5	14.3
B2 (15 °Brix)	15.0	18.0	13.0	15.0	15.3	14.7	17.6	12.7	14.6	14.9	14.4	17.3	12.4	14.3	14.6
B3 (18 °Brix)	18.0	13.0	15.0	18.0	16.0	17.5	12.6	14.5	17.4	15.5	17.2	12.3	14.2	17.1	15.2
Mean	15.3	15.3	15.3	15.3		15.0	15.0	15.0	14.9		14.7	14.7	14.7	14.6	
	S.Em	C.D				S.Em	CD				S.Em	CD			
P (PULP)	0.10	0.28				0.02	0.07				0.02	0.07			
B (TSS)	0.08	0.24				0.02	0.06				0.02	0.06			
B (TSS) × P (PULP)	0.17	0.60				0.04	0.15				0.04	0.15			

Table 2: The effect of different levels of pulp and TSS concentration on ascorbic acid (Mg/100g) of Guava juice

Storage period	Ascorbic acid (Mg/100g)														
	0 Days					30 Days					60 Days				
	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean	P1 (7%)	P2 (10%)	P3 (12%)	P4 (15%)	Mean
B1 (13 °Brix)	190.0	188.0	185.0	195.0	189.5	175.0	172.0	170.0	180.0	174.3	162.0	159.0	157.0	167.0	161.3
B2 (15 °Brix)	192.0	190.0	200.0	198.0	195.0	177.0	175.0	185.0	183.0	180.0	164.0	162.0	172.0	170.0	167.0
B3 (18 °Brix)	195.0	205.0	202.0	200.0	200.5	180.0	190.0	188.0	185.0	185.8	167.0	177.0	175.0	172.0	172.8
Mean	192.3	194.3	195.7	197.7		177.3	179.0	181.0	182.7		164.3	166.0	168.0	169.7	
	S.Em	CD				S.Em	CD				S.Em	CD			
P (PULP)	0.337	0.985				0.312	0.911				0.290	0.847			
B (TSS)	0.292	0.853				0.270	0.789				0.251	0.733			
B (TSS) × P (PULP)	0.585	2.090				0.541	1.932				0.502	1.796			

Table 3: The effect of different levels of pulp and TSS concentration on ascorbic acid (Mg/100g) of Guava juice

Ascorbic acid (Mg/100g)															
Storage period	0 Days					30 Days					60 Days				
Pulp	P1	P2	P3	P4	Mean	P1	P2	P3	P4	Mean	P1	P2	P3	P4	Mean
TSS	(7%)	(10%)	(12%)	(15%)		(7%)	(10%)	(12%)	(15%)		(7%)	(10%)	(12%)	(15%)	
B1 (13 °Brix)	190.0	188.0	185.0	195.0	189.5	175.0	172.0	170.0	180.0	174.3	162.0	159.0	157.0	167.0	161.3
B2 (15 °Brix)	192.0	190.0	200.0	198.0	195.0	177.0	175.0	185.0	183.0	180.0	164.0	162.0	172.0	170.0	167.0
B3 (18 °Brix)	195.0	205.0	202.0	200.0	200.5	180.0	190.0	188.0	185.0	185.8	167.0	177.0	175.0	172.0	172.8
Mean	192.3	194.3	195.7	197.7		177.3	179.0	181.0	182.7		164.3	166.0	168.0	169.7	
	S.Em	CD				S.Em	CD				S.Em	CD			
P (PULP)	0.337	0.985				0.312	0.911				0.290	0.847			
B (TSS)	0.292	0.853				0.270	0.789				0.251	0.733			
B (TSS) × P (PULP)	0.585	2.090				0.541	1.932				0.502	1.796			

Table 4: The effect of different levels of pulp and TSS concentration on total sugar (%) of Guava juice

Total sugar (%)															
Storage period	0 Days					30 Days					60 Days				
Pulp	P1	P2	P3	P4	Mean	P1	P2	P3	P4	Mean	P1	P2	P3	P4	Mean
TSS	(7%)	(10%)	(12%)	(15%)		(7%)	(10%)	(12%)	(15%)		(7%)	(10%)	(12%)	(15%)	
B1 (13 °Brix)	11.5	12.8	14.5	11.8	12.7	11.4	12.7	14.3	11.6	12.5	11.3	12.5	14.1	11.5	12.4
B2 (15 °Brix)	13.0	14.7	12.0	13.3	13.3	12.9	14.5	11.8	13.1	13.1	12.8	14.3	11.6	13.0	12.9
B3 (18 °Brix)	15.0	12.2	13.5	15.2	14.0	14.8	12.0	13.3	15.0	13.8	14.6	11.8	13.1	14.8	13.6
Mean	13.2	13.2	13.3	13.4		13.0	13.1	13.1	13.2		12.9	12.9	12.9	13.1	
	S.Em	CD				S.Em	CD				S.Em	CD			
P (PULP)	0.02	0.06				0.02	0.06				0.02	0.06			
B (TSS)	0.02	0.06				0.02	0.05				0.02	0.05			
B (TSS) × P (PULP)	0.04	0.14				0.04	0.13				0.04	0.13			

Conclusion

Based on the findings, it can be concluded that the increasing the pulp concentration to 12%–15% along with higher TSS levels (18°Brix) was most effective in retaining desirable physicochemical attributes such as TSS, ascorbic acid, acidity, and total sugars during storage. This combination supports better nutritional quality, sensory properties, and extended shelf life of guava juice.

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