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Studies on Antioxidant Activity, Total Phenolic Content and Organoleptic Quality of Lime Blended Aloe RTS

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ABSTRACT

The present experiment was carried out during the year December, 2020 to April, 2021 as Completely randomised design with factorial concept and conducted at PG laboratory, College of Horticulture, Rajendranagar, Hyderabad, Telangana, (500030), India. To develop a healthy ready to serve drink from Aloe and lime juice, the blend comprising of 90:10 and 85:15 Aloe (*Aloe barbadensis*) and lime (*Citrus aurantifolia*), respectively were prepared by addition of two chemical preservatives (KMS 70 ppm and Sodium benzoate 120 ppm) and evaluated for antioxidant activity, total phenols, ascorbic acid content, microbial analysis and organoleptic evaluation for a storage period of three months with 15 days of intervals under ambient and refrigerated storage conditions. There were remarkable changes in the loss of ascorbic acid, total phenol content (folin-ciocalteau method) and antioxidant activities (DPPH) were observed more under ambient storage rather than refrigerated storage during 90 days' period. Organoleptic evaluation revealed that treatment 90:10 (Aloe: lime)+KMS 70 ppm obtained more acceptability in terms of colour, flavour, taste and overall score among the other treatments. Between the two storage conditions, the changes in the quality characteristics of the RTS (ready to serve) drink were slower in refrigerated storage conditions as compared to ambient conditions. Microbial growth is negligible in refrigerated storage, so it was highly recommended.

KEYWORDS: Aloe, antioxidant activity, KMS, lime, sodium benzoate

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1. INTRODUCTION

Aloe barbadensis is a perennial succulent plant belongs to the family, Liliaceae and originated from Arabian Peninsula region. There are more than 250 species of Aloe grown around the world. However, only two species *viz., A. barbadensis* and *A. arborescence* were considered as the most potent species (Valverde et al., 2005). The Arabic word "*Alloeh*," which meaning "bitter and shiny substance". Aloe contains barbaloin (aloin), a glucoside utilized in the pharmaceutical sector to make tablets, ointments, gels, and cosmetics (Chauhan et al., 2007). Because of its nutritional and therapeutic properties (Reynolds, 2004) and has often been referred to as the miracle plant and first aid medicinal plant (Olariu, 2009). The Aloe leaf has two major liquids including a yellow exudate produced by the bundle sheath cells of skin containing mainly anthraquinones, which are used as cathartics, and parenchyma cells containing mucilaginous gel (Femenia et al., 2003). Many of the medicinal effects of gel have been attributed to its bioactive polysaccharide, namely glucomannan (Hamman, 2008).

The leaf gel of aloe contains polysaccharides, which provides wide range of pharmacological effects such as antibacterial, antioxidant, antiulcer, anticancer, antidiabetic, and other immunomodulatory qualities (Zhi et al., 2008). The parenchyma cells contain a transparent, mucilaginous fluid that is known as aloe gel (Bhattacharya et al., 2011) and is thought to be responsible for its medicinal qualities (Shubhra et al., 2014). The presence of vitamins A, C, and E in the gel gives antioxidant, radical scavenging, and anti-inflammatory qualities. For both medical and cosmetic uses, aloe has been utilized in a variety of forms, including fresh gel, juice, and other preparations. (Grindlay and Reynolds, 1986; Borrelli and Izzo, 2000). Due to the expanding global interest in the use of plants and fruits for their proposed health benefits, aloe drink is becoming more accepted (Devi and Rao, 2005). The beverage industry is also turning towards hybridization of traditional beverage. Based on biological processes and functional properties, it can be used as an important food product (Eshun and He, 2010).

These include traditional drinks combined with fruit juices that improve their health-promoting characteristics, flavour and acceptability (Ramachandra and Rao, 2008). Among the Rutaceae family of plants, *Citrus aurantifolia* is a significant medicinal plant. In addition to being a great source of calcium, phosphorus, and iron, fruits are high in vitamin C (Gorinstein et al., 2001). Lime has many health benefits, such as helping with weight loss, skin care, promoting excellent digestion, relieving constipation, protecting the eyes, preventing scurvy, vomiting, and dehydration. It has been demonstrated that citrus fruits, particularly limes, have strong antioxidant qualities that include anti-inflammatory, anti-cancer, and anti-fungal characteristics (Karoui and Marzouk, 2013).

Drinks with two or more ingredients combined are good way to generate a new product and have advantages in terms of taste, nutrition, and health (Niramon et al., 1996). Fruit juice mixing may present a chance to process some fruit varieties that might not otherwise have desirable qualities like color, scent, or mouthfeel (Boghani et al., 2012). Preservatives are a class of chemical compounds that are added to food on purpose to enhance their shelf life during storage. They include organic acids (such as benzoic, sorbic, and propionic acids), sulphates (KMS), ethylene oxide, and sodium nitrates. In moderation, fruit juices and pulp are preserved with the water-soluble chemical potassium metabisulphite. Most fruits naturally contain citric acid, which is also utilized as a preservative.

2. MATERIALS AND METHODS

2.1. Experimental details

Experiment was carried out during the year 2020–2021 as Completely randomised design with factorial concept and conducted at PG laboratory, College of Horticulture, Rajendranagar, Hyderabad, Telangana (500030), India. This experiment comprising of four treatments under different storage conditions as two factors.

Factor – I (Blend along with Chemical preservatives)

T_1: 90: 10 (aloe: lime) + Sodium benzoate (120 ppm); T_2: 90:10 (aloe: lime)+KMS (70 ppm); T_3: 85: 15 (aloe: lime) + Sodium benzoate (120 ppm); T_4: 85: 15 (aloe: lime)+ KMS (70 ppm)

Factor – II (storage condition)

- Ambient storage conditions (C_1)
- Refrigerated storage conditions (C_2)

2.2. Method data collection

2.2.1. Ascorbic acid (mg 100 ml^{-1})

Ascorbic acid of the sample was calculated as mg in 100 ml of sample adopting 2,6 Dichlorophenol-indophenol visual titration method (Ranganna, 1986). Sample of 10 ml was blended with 3% metaphosphoric acid as stabilizing agent and volume was made up to 100 ml with metaphosphoric acid and filtered. Ascorbic acid was estimated by titrating 10 ml of filtrate against 2,6 Dichlorophenol-indophenol dye. The capacity of the sample to reduce the standard dye solution, as determined by titration, is directly proportional to ascorbic acid content present in the sample.

Ascorbic acid (mg 100 ml^{-1})=(Titre value×Dye factor ×Volume made up)/Aliquot of extract×Volume of sample taken)×100

2.2.2. Total antioxidant activity (%)

The antioxidant activity was determined by the ability of

extract to scavenge DPPH (2,2–diphenyl–1–picryl hydrazyl) radical (Brand-Williams et al., 1995 and Michalaska et al., 2007). The reduction of the DPPH radical was determined by measuring the absorption of the resulting oxidized solution at 517 nm against methanol blank. To one ml of methanol, three ml of DPPH was added and used as control. Methanol was used as blank. The percentage inhibition of free radical (DPPH) was calculated as under

Percent inhibition (%)=(AC–AE)/AE×100

Where, AC: Absorption of control

AE: Absorption of extract or standard

2.2.3. Total phenols (mg GAE 100 ml^{-1})

The total phenolic content of blended RTS beverage was determined using the Folin–Ciocalteu method reported by Lukanin et al. (2003). One ml of the sample was taken and extracted with 80% acidified methanol. The extracted sample was centrifuged at 6000 rpm for 15 min. Then Pipetted out 0.5 ml of the aliquot in test tubes and made up the volume to one ml with distilled water and add 0.5 ml Folin- Ciocalteau reagent. Na_2CO_3 7.5% (10 ml) was added to the test tube and mixed it thoroughly. The test tubes were placed in incubator for one hour and the absorbance was measured at 765 nm against the reagent blank. Standard curve using different concentrations of gallic acid was recorded and phenol content of the test sample was expressed as mg GAE 100 ml^{-1}.

2.2.4. Organoleptic evaluation

Organoleptic evaluation was done by a panel of 15 members using 9–point Hedonic scale method as recommended by Ranganna (2001). Different attributes *viz.* colour, flavor, taste, texture and overall acceptability were rated on the basis of 9– point hedonic scale ranging from 1 to 9.

2.2.5. Microbial analysis

Total bacterial count (TBC) and Total mould count (TMC) was determined by using the method given by Tambekar et al., 2009.

2.2.6 Benefit cost ratio

Cost benefit ratio is an important technique to describe the cost of project or investment by comparing the economic benefits with the costs of the activity. Treatment wise cost of production was calculated. Gross returns were calculated by consideration of RTS beverage market price and net returns were calculated by subtracting the cost of production from gross returns then the B:C ratio was calculated by following formula

B:C ratio=Net returns/Cost of production

2.3. Statistical analysis

The data recorded on various parameters in different experiments were subjected to statistical analysis. The experiments were designed under Completely Randomized design with a factorial concept. Observations were recorded with three replications and the data were analysed with 5% level of significance (Panse and Sukhatme, 1985).

3. RESULTS AND DISCUSSION

3.1. Total antioxidant activity

Significantly highest antioxidant activity was recorded in treatment T_4– 85:15 (aloe: lime)+KMS–70 ppm (27.49%) (Table 1), while lowest in treatment T_1–90:10 (aloe: lime)+SB–120 ppm (23.66%) after 90 days of storage.

Table 1: Effect of chemical preservatives and storage conditions on total antioxidant activity (%) of lime blended Aloe RTS

Treatments (T)	Total antioxidant activity (%)											
	Storage conditions (C)											
	Day 1			15th Day			30th Day			45th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	46.13	46.14	46.14^{d}	45.90	46.07	45.99^{d}	40.97	41.38	41.18^{d}	37.22	38.87	38.05^{d}
T_2	46.43	46.45	46.44^{c}	46.24	46.43	46.34^{c}	42.77	43.39	43.08^{c}	39.05	40.95	40.00^{c}
T_3	47.36	47.38	47.37^{b}	47.24	47.38	47.31^{b}	43.47	44.07	43.77^{b}	39.87	41.13	40.50^{b}
T_4	47.44	47.46	47.45^{a}	47.33	47.44	47.39^{a}	43.83	45.13	44.48^{a}	40.23	42.35	41.29^{a}
Mean	46.83^{b}	46.86^{a}		46.68^{b}	46.83^{a}		42.76^{b}	43.49^{a}		39.10^{b}	40.83^{a}	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.009		0.027	0.005		0.015	0.005		0.017	0.011		0.033
C	0.006		0.019	0.003		0.010	0.004		0.012	0.008		0.023
T×C	0.013		0.038	0.007		0.021	0.008		0.023	0.015		0.046

Table 1: Continue...

Treatments (T)	Total antioxidant activity (%)								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	32.18	34.94	33.56[d]	27.45	29.73	28.59[d]	22.15	25.17	23.66[d]
T_2	35.35	38.44	36.90[b]	29.55	33.45	31.50[b]	24.23	28.43	26.33[b]
T_3	35.15	37.95	36.55[c]	29.06	32.94	31.00[c]	23.55	27.92	25.74[c]
T_4	37.15	38.84	38.00[a]	31.26	34.16	32.71[a]	25.16	29.82	27.49[a]
Mean	34.96[b]	37.54[a]		29.33[b]	32.57[a]		23.77[b]	27.84[a]	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.012		0.038	0.014		0.043	0.016		0.048
C	0.009		0.027	0.010		0.030	0.011		0.034
T×C	0.018		0.054	0.020		0.060	0.022		0.068

C_1: Ambient storage; C_2: Refrigerated storage; T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm

Antioxidant activity decreased less significantly in samples stored under refrigerated condition (46.86–27.84%) compared to ambient storage (46.83–23.77%). Similar results were observed by Singh et al. (2018) that DPPH activity decreased (42.35±0.39 to 41.43±0.11%) less significantly in sample stored under 10°C during the storage period than stored under 25°C. The decreasing trend during storage is linked with the fact of lower content of phenolic compounds and vitamin C that influence antioxidant activity directly. Similar results were found by Tariq et al. (2020) in apple olive RTS beverage and Kausar et al. (2020) in orange–Aloe blended RTS beverage.

3.2. Total phenols

The perusal data (Table 2) related to total phenols of lime blended Aloe RTS is indicating that virtual decrease in total phenol content during storage. Highest total phenols were reported in treatment T_4–85:15 (aloe: lime)+KMS–70 ppm which is decreased (58.16–26.60 mg GAE 100 ml^{-1}) during 3 months. This gradual reduction in total phenolic content at both storage conditions might be due to their polymeric oxidation towards the formation of brown pigments (Hemalatha et al., 2018). Slower rate of loss of phenols in refrigerated storage might be due to slower reaction rate in refrigerated condition (57.97–26.28 mg GAE 100 ml^{-1})

Table 2: Effect of chemical preservatives and storage conditions on total phenols (mg GAE 100 ml^{-1}) of lime blended Aloe RTS

Treatments (T)	Total phenols (mg GAE 100 ml^{-1})											
	Storage conditions (C)											
	Day 1			15th Day			30th Day			45th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	57.64	57.65	57.65[d]	57.53	57.65	57.60[d]	54.79	54.94	54.87[d]	47.60	48.37	47.92[d]
T_2	57.92	57.94	57.93[c]	57.86	57.94	57.91[c]	55.01	55.26	55.14[c]	48.62	49.35	48.99[c]
T_3	58.11	58.14	58.13[b]	58.04	58.11	58.08[b]	55.70	55.89	55.80[ab]	49.56	50.22	49.89[b]
T_4	58.15	58.16	58.16[a]	58.07	58.18	58.12[a]	55.72	55.95	55.84[a]	50.20	50.53	50.37[a]
Mean	57.95[b]	57.97[a]		57.87[b]	57.98[a]		55.31[b]	55.51[a]		49.00[b]	49.62[a]	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.005		0.015	0.009		0.027	0.040		0.122	0.061		0.185
C	0.003		0.010	0.006		0.019	0.029		0.086	0.043		0.131
T×C	0.007		0.021	0.013		0.038	0.057		0.173	0.087		0.262

Table 2: Continue...

Treatments (T)	Total phenols (mg GAE 100 ml^{-1})								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	36.77	36.96	36.87^{d}	29.19	29.49	29.34^{d}	24.26	24.71	24.49^{d}
T_2	37.15	37.95	37.55^{b}	31.28	32.85	32.07^{b}	25.94	26.75	26.34^{b}
T_3	36.93	37.84	37.38^{c}	30.72	32.14	31.43^{c}	25.13	26.54	25.84^{c}
T_4	37.75	38.17	37.96^{a}	31.86	33.05	32.46^{a}	26.08	27.11	26.60^{a}
Mean	37.15^{b}	37.73^{a}		30.76^{b}	31.88^{a}		25.35^{b}	26.28^{a}	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.011		0.034	0.037		0.113	0.082		0.247
C	0.008		0.024	0.026		0.080	0.058		0.175
T×C	0.015		0.047	0.053		0.160	0.115		0.349

C_1: Ambient storage; C_2: Refrigerated storage; T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm

when compared to ambient conditions (57.95–25.35 mg GAE 100 ml^{-1}). Similar results were reported by Singh et al. (2014) in ginger honey RTS.

3.3. Ascorbic acid

The data concerning to changes in ascorbic acid content of RTS during storage is presented in Table 3. The mean score of Ascorbic acid content was recorded significantly highest in treatment T_4-85:15 (aloe: lime)+KMS–70 ppm (9.84–6.05 mg 100 ml^{-1}). Ascorbic acid content decreased more significantly during storage under ambient (9.64–5.75 mg 100 ml^{-1}) as compared to refrigerated storage (9.68–5.84 mg 100 ml^{-1}). Losses of ascorbic acid during storage were attributed due to non-reversing reaction that is change of L–ascorbic acid in to dehydro ascorbic acid in the presence of O_2 and directly affected by temperature and light exposure Singh et al. (2018).

3.4. Microbial analysis

3.4.1. Total mould count (CFU ml^{-1})

It is evident from results that mould growth was not detected up to 90 days of storage of samples stored under refrigerated storage condition (C_2). Meanwhile, slight mould count was observed in ambient stored samples after 90 days of storage. Minimum mould count was observed in T_2 and T_4 treatments might be due to low pH and KMS

Table 3: Effect of chemical preservatives and storage conditions on ascorbic acid (mg 100 ml^{-1}) of lime blended Aloe RTS

Treatments (T)	Ascorbic acid (mg 100 ml^{-1})											
	Storage conditions (C)											
	Day 1			15th Day			30th Day			45th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	9.49	9.54	9.51^{d}	9.41	9.47	9.44^{d}	9.27	9.36	9.32^{d}	8.45	8.69	8.57^{d}
T_2	9.56	9.61	9.59^{c}	9.49	9.55	9.52^{c}	9.40	9.49	9.44^{c}	8.86	8.99	8.93^{c}
T_3	9.72	9.71	9.71^{b}	9.62	9.63	9.63^{b}	9.52	9.53	9.53^{b}	9.01	9.21	9.11^{b}
T_4	9.81	9.86	9.84^{a}	9.73	9.79	9.76^{a}	9.65	9.70	9.67^{a}	9.15	9.31	9.23^{a}
Mean	9.64^{b}	9.68^{a}		9.57^{b}	9.61^{a}		9.46^{b}	9.52^{a}		8.87^{b}	9.05^{a}	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.007		0.022	0.008		0.024	0.009		0.028	0.011		0.034
C	0.005		0.016	0.006		0.017	0.006		0.020	0.008		0.024
T×C	0.010		0.032	0.011		0.034	0.013		0.039	0.016		0.048

Table 3: Continue...

Treatments (T)	Ascorbic acid (mg 100 ml^{-1})								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	7.12	7.14	7.13^{d}	6.24	6.61	6.43^{d}	5.24	5.28	5.26^{d}
T_2	7.26	7.19	7.22^{c}	6.64	6.68	6.66^{c}	5.94	6.01	5.98^{b}
T_3	7.69	7.78	7.74^{b}	6.85	7.13	6.99^{b}	5.86	5.97	5.92^{c}
T_4	7.73	7.84	7.79^{a}	6.89	7.17	7.03^{a}	5.95	6.11	6.05^{a}
Mean	7.45^{b}	7.49^{a}		6.66^{b}	6.90^{a}		5.75^{b}	5.84^{a}	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.010		0.030	0.008		0.025	0.010		0.029
C	0.007		0.021	0.006		0.017	0.007		0.021
T×C	0.014		0.043	0.012		0.035	0.014		0.041

C_1: Ambient storage; C_2: Refrigerated storage; T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm

treated samples recorded less mould growth among other treatments. Similar findings were reported by Selvi et al. (2013) in guava–lime–ginger RTS beverage. Akubor (2017) found that the total plate count of mould increased from 10 CFU g^{-1} in the fresh squash to 30 CFU g^{-1} at the end of the storage period (Table 4).

3.4.2. Total bacterial count (CFU ml^{-1})

The results showed that there was no bacterial growth noticed in lime blended Aloe RTS up to 30 days of storage. This might be due to the antimicrobial properties of aloe vera and lime and addition of preservatives. After 45 days of storage slight bacterial growth was observed. Between the storage conditions minimum bacterial count was observed in refrigerated storage (C_2) while comparing with ambient storage (C_1) after 90 days of storage (Table 5).

3.5. Organoleptic evaluation

The organoleptic score of lime blended aloe RTS declined while increasing the storage period. The quality of colour, flavour, taste, texture and overall acceptability of drink was decreased and these changes were more in ambient storage compared to refrigerated storage. Treatment 90:10 (aloe: lime)+KMS–70 ppm was recorded highest overall acceptability among the others (Table 6).

Table 4: Effect of chemical preservatives and storage conditions on total mould count (CFU ml^{-1}) of lime blended Aloe RTS

Treatments (T)	Total mould count (CFU ml^{-1}×10^{-2} dilution)											
	Storage conditions (C)											
	Day 1			15th Day			30th Day			45th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T_2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T_3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
T_4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean	ND	ND		ND	ND		ND	ND		ND	ND	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	-		-	-		-	-		-	-		-
C	-		-	-		-	-		-	-		-
T×C	-		-	-		-	-		-	-		-

Table 4: Continue...

Treatments (T)	Total mould count (CFU $ml^{-1}\times10^{-2}$ dilution)								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	ND	ND	ND	ND	ND	ND	1.8	ND	0.9
T_2	ND	ND	ND	ND	ND	ND	1.1	ND	0.6
T_3	ND	ND	ND	ND	ND	ND	1.4	ND	0.7
T_4	ND	ND	ND	ND	ND	ND	1.2	ND	0.6
Mean	ND	ND		ND	ND		1.4	ND	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	-		-	-		-	0.012		0.037
C	-		-	-		-	0.009		0.026
T×C	-		-	-		-	0.017		0.057

C_1: Ambient storage; C_2: Refrigerated storage; T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm; ND: Not detected

3.6. Benefit cost ratio

The data indicated that the highest expenditure of product preparation (119.22) was noticed in the treatment T_3–85:15 (Aloe: lime) +Sodium benzoate–120 ppm whereas, it was least (112.57) for treatment T_2 – 90:10 (Aloe: lime) +KMS –70 ppm (Table 7). The peak net return (187.43) and B:C ratio (1.67) was noticed in the treatment T_2, while least net returns (180.78) and B:C ratio (1.51) was recorded for T_3 treatment. The high B:C ratio for the T_2 treatment might be associated with profitable gross economic returns and

Table 5: Effect of chemical preservatives and storage conditions on total bacterial count (CFU ml^{-1}) of lime blended Aloe RTS

Treatments (T)	Total bacterial count (CFU $ml^{-1}\times10^{-2}$ dilution)											
	Storage conditions (C)											
	Day 1			15th Day			30th Day			45th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	1.4	2.0^{d}
T_2	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	0.8	1.4^{b}
T_3	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	1.1	1.5^{bc}
T_4	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	0.5	0.9^{a}
Mean	ND	ND		ND	ND		ND	ND		1.9^{b}	1.0^{a}	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	-		-	-		-	-		-	0.065		0.195
C	-		-	-		-	-		-	0.046		0.138
T×C	-		-	-		-	-		-	0.092		0.276

Treatments (T)	Total bacterial count (CFU $ml^{-1}\times10^{-2}$ dilution)								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	5.9	5.2	5.6^{d}	8.0	7.1	7.6^{d}	9.1	7.9	8.5^{d}
T_2	5.4	3.7	4.5^{b}	7.3	5.5	6.4^{b}	8.5	6.5	7.5^{b}
T_3	4.9	4.2	4.6^{bc}	6.6	6.3	6.5^{bc}	7.8	7.2	7.6^{bc}

Table 5: Continue...

Treatments (T)	Total bacterial count (CFU $ml^{-1}\times10^{-2}$ dilution)								
	Storage conditions (C)								
	60th Day			75th Day			90th Day		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_4	4.1	3.2	3.7[a]	6.1	5.1	5.6[a]	7.2	5.8	6.5[a]
Mean	5.1[b]	4.1[a]		7.0[b]	6.0[a]		8.2[b]	6.9[a]	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.010		0.300	0.116		0.347	0.110		0.331
C	0.071		0.211	0.082		0.246	0.078		0.234
T×C	0.141		0.423	0.164		0.491	0.156		0.467

C_1: Ambient storage; C_2: Refrigerated storage; T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm; ND: Not detected

Table 6: Effect of chemical preservatives and storage conditions on organoleptic quality of lime blended Aloe RTS after 90 days of storage

Treatments (T)	Organoleptic evaluation														
	Colour			Flavour			Taste			Texture			Overall acceptability		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
T_1	6.8	7.3	7.1[b]	6.8	7.1	7.0[c]	6.7	7.2	7.0[c]	6.7	7.2	7.0[c]	6.6	7.5	7.1[c]
T_2	7.0	7.4	7.2[a]	7.1	7.6	7.4[a]	7.0	7.7	7.4[a]	6.9	7.5	7.2[a]	7.2	7.8	7.5[a]
T_3	6.5	6.9	6.7[d]	6.7	7.0	6.9[d]	6.5	6.8	6.7[d]	6.5	6.7	6.6[d]	6.5	7.3	6.9[d]
T_4	6.7	7.2	7.0[c]	6.9	7.4	7.2[b]	6.8	7.3	7.1[b]	6.6	7.0	6.8[b]	6.9	7.6	7.3[b]
Mean	6.8[b]	7.2[a]		6.9[b]	7.3[a]		6.8[b]	7.3[a]		6.7[b]	7.1[a]		6.8[b]	7.6[a]	
	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)	SEm±		CD (p=0.05)
T	0.008		0.025	0.027		0.081	0.024		0.073	0.017		0.051	0.021		0.062
C	0.006		0.018	0.019		0.057	0.017		0.051	0.012		0.036	0.015		0.044
T×C	0.012		0.035	0.038		0.114	0.034		0.103	0.024		0.072	0.029		0.088

Table 7: Benefit-cost ratio of the lime blended Aloe RTS drink

Treatment details	Cost of preparation ₹ $litre^{-1}$	Gross returns ₹ $litre^{-1}$	Net returns ₹ $litre^{-1}$	B:C ratio
T_1	113.22	300	186.78	1.65
T_2	112.57	300	187.43	1.67
T_3	119.22	300	180.78	1.51
T_4	118.57	300	181.43	1.53

T_1: 90:10 (Aloe: lime)+Sodium benzoate-120 ppm; T_2: 90:10 (Aloe: lime)+KMS -70 ppm; T_3: 85:15 (Aloe: lime)+Sodium benzoate-120 ppm; T_4: 85:15 (Aloe: lime)+KMS-70 ppm; 1US$=INR 74.45

relatively moderate expenditure of product preparation.

4. CONCLUSION

The 90:10 (aloe: lime) + KMS–70 ppm (T_2) stored at refrigerated condition (C_2) was found to be satisfactory in terms of sensory and nutritional quality also scored highest benefit cost ratio (1.67).

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