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Development of Moringa energy drink blended with pineapple

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Abstract

An experiment was conducted at Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Raipur, Chhattisgarh in laboratory condition during 2020-21 to develop Moringa energy drink blended with pineapple. The experiment was laid out in Completely Randomized Design (CRD) with 03 replications and 08 treatments. Various chemical, nutritional and economics parameters were recorded under this investigation. The result revealed that the total soluble solid (TSS), total sugar, reducing sugar, total soluble solid, non-reducing sugar, ascorbic acid, acidity, TSS: Acid were significantly superior in the treatment T₁ (10:90). The quality and sensory evaluation observations i.e. color, appearance, taste, aroma and overall acceptability significantly found superior in the treatment T₁ (10:90). The economic parameters like product production cost, product gross returns, product net returns and product benefit cost ratio (B: C) (3.41) were also found superior in the treatment T₁ (10:90). While the lowest benefit cost ratio (1.21) found in treatment T₇ (40:60). Therefore it may be concluded that treatment T₁ (10:90) may be selected for making best quality moringa energy drink blended with pineapple.

Keywords: Moringa, energy drink, pineapple, nutritional and sensory evaluation

Introduction

Drumstick (*Moringa oleifera* Lam.) is one of the important perennials grown in the state of Chhattisgarh. Each part of the plant (flowers, leaves, pods and stems) is considered valuable for food, and is also rich in nutrition, minerals and vitamins. It is popular because of its unique flavor and attractive taste. Drumstick leaves are better than flowers, stems, pods and roots and are the most nutritious leaves in the world. The leaves of this plant have been reported to having highest amount of essentially amino acid with the right balance, as well as high amount of minerals and vitamins (Fuglie, 2009) [5]. Pineapple fruit most popular tropical fruit that are well known for its juice and sweet tasty. This fruit is richest in nutrition and contain highest amount of vitamin, fibers, mineral and enzyme. This healthy nutrition fruit can be eaten raw is can be used in preparing various taste recipe. The micro nutrient contents of this fruit help to protecting us from much disease like cancer, stroke and other heart problems. The tender leaves of Moringa can be better utilized after value addition. However, no reports exist on the preservation or processing on Moringa energy drink and its impact on the sensory and storage quality of the products. It can be achieved by making energy rich Moringa drink products blended with pineapple flavor.

Materials and Methods

The experiment was laid out in Completely Randomized Design (CRD) with three replications and eight treatments at Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Raipur, Chhattisgarh in laboratory condition, during 2020-21. The fresh, mature, dark green and healthy leaves of *Moringa oleifera* was procured. Moringa leaves was washed, blanched to remove flavour and bitterness, hand operated / screw type juice extractor extract by using hydraulic press and the extracted juice was again filtered by using a four layer muslin cloth to remove remaining pomace. Ripens well matured pineapple fruits were chosen for making moringa energy drink beverage with pineapple flavour. The selected fruits were cleaned with tap water free of dirt and unwanted material. The fruit is peeled, sliced removing the eyes and using a hand operated/screw type juicer extractor using hydraulic press and using a four layer muslin cloth to extract the juice.

After juice separation, as per treatment extract was taken for moringa energy drink making respectively as shown in Table 1. Calculated quantity of sugar is mixed in the moringa energy drink to maintain its TSS and acidity in the final product are maintained 0.3% by adding

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required amount of citric acid and sodium benzoate 100 ppm mixed in per litre moringa energy drink. Five bottles was randomly selected and labeled in each treatment for recording the observations at different intervals. The storage life and nutritive value of energy drink of Moringa was assess in 0, 30, 60 and 90 days interval after drink preparation.

Chemical and nutritional evaluation for various nutrients Ascorbic acid and Terrible Acidity (%) was calculated as per standard method described by Ranganna (1997) [9]. The

energy drink of moringa beverages prepared from moringa and pineapple fruit was assigned to organoleptic examination *i.e.* (color determination, flavor, taste determination, aroma) by group of judges following the nine point hedonic rating test as described by Ranganna (1997) [9]. Benefit cost ratio is the ratio of net return and cost of production was worked out. Data recorded on various aspects in the laboratory was subjected to statistical analysis of variance technique was given by Gomez and Gomez (1985) [6].

Table 1: Treatment details for preparing moringa energy drink (pineapple flavour)

Ingredients used	Treatment Combination (%)		
	Moringa Leaf Extract		Pineapple Extract
20% of pulp extract, 15% of sugar, 0.3% of acidity as % of anhydrous citric acid and 100 ppm of sodium benzoate one liter of water	T ₁	10	: 90
	T ₂	15	: 85
	T ₃	20	: 80
	T ₄	25	: 75
	T ₅	30	: 70
	T ₆	35	: 65
	T ₇	40	: 60
	T ₈	Pure Moringa Leaf 20% (Control)	

Results and Discussion

Data related to outcome of various recipe treatments on total sugar value, reducing sugar value and non-reducing sugar value of moringa energy drink at room temperature preservation are displayed in Table 2. Although considerable variation have been observed in the reducing sugar value at different interval of preservation. After 90 days storage of moringa energy drink higher total sugar value (12.71) was observed with the treatment T₁ (10:90) followed by treatment T₂ (15:85), T₃ (20:80) and T₄ (25:75), whereas maximum reducing sugar value (4.53) was observed with the treatment T₁ (10:90) followed by treatment T₂ (15:85), T₃ (20:80) and T₄ (25:75) after 90 days storage of moringa energy drink. The reduction of non-reducing sugar into reducing sugar causes

rise in sugar level in product at time of preservation. The similar findings have also been reported by Bhuiyan *et al.* (2012) [1] and Chinwe *et al.* (2015) [3]. The maximum non-reducing sugar value (7.77) was noted with the treatment T₁ (10:90) followed by treatment T₂ (15:85), T₃ (20:80) and T₄ (25:75), on other hand, minimum non-reducing sugar value (7.34) was recorded with the treatment T₈ (Pure moringa leaves 20% (Control)). The decline in non-reducing sugar might be because of eventual rise in total sugar and reducing sugar which is consequences of breakdown of complex sugar like pectin and breakdown of non-reducing sugar to reducing sugar. Results collaborate with the finding of Bhuiyan *et al.* (2012) [1] and Chinwe *et al.* (2015) [3].

Table 2: Influence of storage period on sugar (%) of Moringa Energy Drink

Treatment combination (Moringa leaf extract: Pineapple extract)	Total sugar (%)				Reducing sugar (%)				Non-reducing sugar (%)			
	Storage period (in days)				Storage period (in days)				Storage period (in days)			
	0	30	60	90	0	30	60	90	0	30	60	90
T ₁ (10:90)	12.50	12.57	12.66	12.71	4.38	4.43	4.48	4.53	7.71	7.73	7.77	7.77
T ₂ (15:85)	12.45	12.50	12.60	12.65	4.35	4.40	4.45	4.50	7.70	7.70	7.74	7.74
T ₃ (20: 80)	12.35	12.40	12.50	12.55	4.32	4.37	4.42	4.47	7.63	7.63	7.68	7.68
T ₄ (25:75)	12.30	12.35	12.45	12.50	4.26	4.31	4.39	4.41	7.64	7.64	7.66	7.69
T ₅ (30:70)	12.23	12.28	12.42	12.47	4.21	4.26	4.31	4.36	7.62	7.62	7.70	7.70
T ₆ (35:65)	12.10	12.15	12.25	12.30	4.18	4.23	4.28	4.33	7.52	7.52	7.57	7.57
T ₇ (40:60)	12.00	12.05	12.15	12.20	4.15	4.20	4.25	4.30	7.46	7.46	7.51	7.51
T ₈ (Pure moringa leaf 20% as control)	11.90	11.95	11.97	12.00	4.12	4.10	4.22	4.27	7.39	7.46	7.36	7.34
SEm (±)	0.05	0.06	0.06	0.07	0.02	0.03	0.02	0.02	0.02	0.04	0.04	0.04
CD (1%)	0.24	0.25	0.28	0.29	0.12	0.13	0.11	0.12	0.11	0.18	0.19	0.19
CV (%)	0.82	0.84	0.96	0.99	1.18	1.31	1.10	1.15	0.63	0.99	1.05	1.05

Data related to outcome of various recipe treatments on Total Soluble Solid, Ascorbic acid and Acidity value of moringa energy drink at room temperature preservation are presented in Table 3. Although considerable variation have been observed in the Total Soluble Solid value at time of preservation for different interval. Table 3 showed the highest Total Soluble Solid (16.20) was observed with the treatment T₁ (10:90) followed by treatment T₂ (15:85), T₃ (20:80) and T₄ (25:75) after 90 days storage of moringa energy drink, while the lowest Total Soluble Solid value (14.90) was observed with the treatment T₈ (Pure moringa leaves 20% (Control)). The rise in TSS might be due to fact that dragon

fruit juice has high TSS initially and room temperature accelerated the biochemical changes of conversion of complex sugar into simple sugar. The results are accordance with the finding of Awsi and Masih (2012) [8] & Ekeledo (2013) [4]. After 90 days storage of moringa energy drink, highest ascorbic acid content (11.40) was recorded in the treatment T₁ (10:90), whereas the lowest ascorbic acid content (2.80) was noted in the treatment T₈ (Pure moringa leaves 20% (Control)). The non-reversing reaction that is change of L-ascorbic acid into dehydroascorbic acid in availability of enzyme recombinase which is caused by confined or residual O₂ inside glass bottles. Thus these might be cause of decline

in ascorbic acid in RTS and Nectar in course of preservation. Also similar result found by Gupta *et al.* (2008) [1]. The maximum acidity (0.50) was observed in the treatment T₁ (10:90), while the minimum acidity (0.41) was observed in the treatment T₈ (Pure moringa leaves 20% (Control)) under

study after 90 days storage of moringa energy drink. Degradation of ascorbic acid forms organic acids beside there might be breakdown of pectin composition. Thus this might be responsible for rise in acidity. Finding is accordance with the results of Ekeledo (2013) [4] and Biswas *et al.* (2016) [2].

Table 3: Evaluation of TSS, Ascorbic acid and Acidity of Moringa energy drink under different days of storage condition.

Treatment combination (Moringa leaf extract: Pineapple extract)	TSS (°Brix)				Ascorbic acid				Acidity (%)			
	Storage period (in days)				Storage period (in days)				Storage period (in days)			
	0	30	60	90	0	30	60	90	0	30	60	90
T ₁ (10:90)	15.00	15.50	16.00	16.20	13.10	12.63	11.60	11.40	0.35	0.40	0.45	0.50
T ₂ (15:85)	14.80	15.30	15.80	16.00	10.70	10.20	9.20	9.00	0.34	0.39	0.44	0.49
T ₃ (20 : 80)	14.70	15.20	15.70	15.90	8.30	7.80	6.80	6.60	0.31	0.36	0.41	0.46
T ₄ (25 :75)	14.60	15.10	15.50	15.80	7.20	6.70	5.70	5.50	0.30	0.35	0.40	0.45
T ₅ (30 :70)	14.00	14.50	15.13	15.20	6.00	5.50	4.50	4.17	0.29	0.34	0.39	0.44
T ₆ (35 : 65)	13.83	14.38	14.80	15.00	5.10	4.60	3.60	3.40	0.28	0.33	0.38	0.43
T ₇ (40:60)	13.80	14.30	14.73	14.95	4.80	4.30	3.30	3.10	0.27	0.32	0.37	0.42
T ₈ (Pure moringa leaf 20% as control)	13.70	14.27	14.60	14.90	4.50	4.00	2.93	2.80	0.26	0.31	0.36	0.41
SEm (±)	0.06	0.07	0.08	0.06	0.07	0.08	0.07	0.08	0.007	0.009	0.01	0.01
CD (1%)	0.26	0.31	0.34	0.27	0.32	0.33	0.31	0.33	0.03	0.04	0.04	0.05
CV (%)	0.76	0.89	0.94	0.73	1.77	1.99	2.17	2.41	3.98	4.27	4.32	4.44

Data related to outcome of various treatments on TSS acid ratio and pH value of moringa energy drink at room temperature are displayed in Table 4. It is evident from findings that the TSS acid ratio and p^H value of energy drink shows diminishing pattern with enhancement in course of preservation (0-90 days). The higher TSS acid ratio value (36.39) was observed in the treatment T₈ (Pure moringa leaves 20% (Control)), whereas the lower TSS acid ratio value observed was 32.43 in the treatment T₁ (10:90) after 90 days storage of moringa energy drink. The TSS Acid Ratio

shows decreasing trend it might be due to increase in TSS and acidity. After 90 days storage of moringa energy drink maximum pH value (3.73) was recorded by the treatment T₁ (10:90), while the minimum pH value (2.67) was noted by the treatment T₈ (Pure moringa leaves 20% (Control)). Similar result was also found by Vanajakshi *et al.* (2015) [10] and Biswas *et al.* (2016) [2] that pH value increased with passage of preservation period of 3 month. Simultaneously there was rise in acidity value due to reaction between organic acid and pigment and this might be reason for pH increase.

Table 4: Influence of storage period on TSS Acid ratio and pH of moringa energy drink

Treatment combination (Moringa leaf extract: Pineapple extract)	TSS Acid ratio				pH			
	Storage period (in days)				Storage period (in days)			
	0	30	60	90	0	30	60	90
T ₁ (10:90)	43.28	38.76	35.60	32.43	4.90	4.43	3.93	3.73
T ₂ (15:85)	43.97	39.29	35.67	32.68	4.34	3.84	3.34	3.14
T ₃ (20 : 80)	47.94	42.24	38.31	34.61	4.31	3.81	3.31	3.11
T ₄ (25 :75)	48.80	42.74	38.82	35.15	4.25	3.75	3.25	3.05
T ₅ (30 :70)	48.32	42.28	38.85	34.59	4.08	3.58	3.08	2.88
T ₆ (35 : 65)	49.55	43.67	38.68	34.93	4.01	3.51	3.04	2.72
T ₇ (40:60)	51.15	44.79	39.47	35.64	3.92	3.42	2.92	2.68
T ₈ (Pure moringa leaf 20% as control)	52.04	45.58	40.64	36.39	3.88	3.38	2.88	2.67
SEm (±)	1.06	0.95	0.93	0.78	0.05	0.05	0.06	0.06
CD (1%)	4.40	3.94	NS	NS	0.24	0.23	0.25	0.28
CV (%)	3.83	3.89	4.24	3.92	2.37	2.58	3.23	3.88

Under organoleptic evaluation, the mean score data for color, appearance, taste, aroma and overall acceptance shows that Treatment T₁ (10:90) (9.00) was more highly rated for color (Table 5). Minimum proportion of Moringa juice in the formulation improved the color appreciation by the panelists. This could be attributed to consumers not being familiar with green beverages, and hence the less green the color of the juice the higher it was scored. Table 5 exhibited that the highest mean score (9.00) for taste was obtained when Moringa leaf extract at its lowest level. The taste of the beverage was not much liked when moringa at the maximum level. The minimum acceptable taste and aroma (mean score of 6.57 and 5.95 respectively) was found in Treatment T₈ (Control)) that had the pure fresh moringa leaf extract (20%). Using fresh moringa juice without mixing it with pineapple

resulted in a taste and aroma that was least liked by the consumers. A reduction in the amount moringa blended with maximum level of pineapple gave an acceptable highest mean score of 9.00 and 8.72 respectively (Table 5). The decrease in aroma and taste score with increasing Moringa levels was probably due to the strong herbal flavor. The recipe T₁ (Moringa leaf extract: Pineapple extract :10:90) not only obtained top score in overall acceptability but also high rated in color (9.00), appearance (8.63), taste (9.00) and aroma (8.76) as compared to other recipes. The result showed that the judges like moringa energy drink with moringa leaves extract: pineapple pulp extract (10:90). The results obtained in the present studies are support by the Bhuiyan *et al.* (2012) [1] and Ekeledo (2013) [4].

Table 5: Mean consumer scores for color, appearance, taste, aroma and overall acceptance with moringa energy drink)

Treatment combination (Moringa leaf extract: Pineapple extract)	Color	Appearance	Taste	Aroma	Overall acceptability	Rating
T ₁ (10:90)	9.00	8.63	9.00	8.76	8.85	Like very much
T ₂ (15:85)	8.32	8.23	8.27	8.53	8.34	Like moderately
T ₃ (20 : 80)	7.70	7.82	7.87	7.65	7.76	Like slightly
T ₄ (25 :75)	7.44	7.40	7.83	7.60	7.57	Like slightly
T ₅ (30 :70)	7.15	7.02	7.73	7.33	7.31	Like slightly
T ₆ (35 : 65)	6.97	7.00	7.37	6.65	7.00	Like slightly
T ₇ (40:60)	6.85	6.70	6.80	6.50	6.71	Like slightly
T ₈ (Pure moringa leaf 20% as control)	6.43	6.30	6.57	5.95	6.31	Like slightly

Economics is the most important aspect of any research upon which the recommendation depends on data pertaining to total production cost (Rs.), gross return (Rs.), net return (Rs.) and B: C ratio as affected by different treatments have been presented in Table 6. The highest production cost for 100 liter (Rs. 6800.00) was recorded in treatment T₁ (10:90) to T₇ (40:60) as similar cost, whereas the minimum cost of production (Rs 5200.00) was noted by T₈ (Pure moringa leaf 20% as control). The highest gross return for 100 liter (Rs. 30,000.00) was recorded in treatment T₁ (10:90) followed by treatment T₂ (15:85) and T₃ (20: 80), while the lowest gross return for 100 liter (12500 Rs.) was recorded in the treatment T₈ (Pure moringa leaf 20% as control) under study. Table 6 showed that the highest net return for 100 liter (Rs. 23200.00) was observed in treatment T₁ (10:90) followed by treatment T₂

(15:85) and T₃ (20: 80). On other hand, the lowest net return for 100 liter (Rs. 7300.00) was exhibited by the treatment T₈ (Pure moringa leaf 20% as control). The highest Benefit: cost ratio (3.41) was also recorded in treatment T₁ (10:90), whereas the lowest Benefit: cost ratio (1.21) was recorded in the treatment T₇ (40:60). In the present investigation, the highest gross return and net return for 20 liter were recorded in treatment T₁ (10:90) followed by treatment T₂ (15:85) and T₃ (20: 80). While the lowest gross return and net return for 20 liter were recorded in the treatment T₈ (Pure moringa leaf 20% as control). The highest Benefit: cost ratio (3.41) was also recorded in treatment T₁ (10:90) followed by treatment T₂ (15:85) and T₃ (20: 80), whereas the lowest Benefit: cost ratio (1.21) was recorded in the treatment T₇ (40:60).

Table 6: Economics of Moringa Energy Drink.

Treatment combination (Moringa leaf extract: Pineapple extract)	Total production cost for 100 liter (Rs.)	Gross return for 100 liter (Rs.)	Net return for 100 liter (Rs.)	B: C ratio
T ₁ (10:90)	6800	30000	23200	3.41
T ₂ (15:85)	6800	27500	20700	3.04
T ₃ (20 : 80)	6800	25000	18200	2.68
T ₄ (25 :75)	6800	22500	15700	2.31
T ₅ (30 :70)	6800	20000	13200	1.94
T ₆ (35 : 65)	6800	17500	10700	1.57
T ₇ (40:60)	6800	15000	8200	1.21
T ₈ (Pure moringa leaf 20% as control)	5200	12500	7300	1.40

Conclusion

On the basis of result, the chemical and nutritional evaluation of total sugar, reducing sugar, non-reducing sugar, total soluble solid, ascorbic acid, acidity, TSS acid ratio were significantly superior in the treatment T₁ (10:90). The quality and sensory evaluation like color, appearance, taste, aroma and overall acceptability significantly superior in the treatment T₁ (Moringa leaf extract: Pineapple extract: 10:90) followed by treatment T₂ (15:85). The economic parameters like cost of production, gross returns, net returns and B: C ratio (3.41) were superior in the treatment T₁ (10:90), where the lowest B: C ratio (1.21) found in treatment T₇ (40:60). Therefore it may be concluded that treatment T₁ (Moringa leaf extract: Pineapple extract: 10:90) may be prefer for making best quality moringa energy drink blended with pineapple flavour.

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