

Original Research Article

Effect of different levels of local yeast in pomegranate (*Punica granatum* L.) cider

Abstract

The study was conducted in Completely Randomized Design (CRD) with 7 treatments replicated thrice. The treatments were T1 (pomegranate juice 1ltr + 0.5g yeast + 500g sugar), T2 (pomegranate juice 1ltr + 1g yeast + 500g sugar), T3 (pomegranate juice 1ltr + 1.5g yeast + 500g sugar), T4 (pomegranate juice 1ltr + 2g yeast + 500g sugar), T5 (pomegranate juice 1ltr + 2.5g yeast + 500g sugar), T6 (pomegranate juice 1ltr + 3g yeast + 500g sugar), T7 (pomegranate juice 1ltr + 3.5g yeast + 500g sugar). Total soluble solids, pH and Specific Gravity decreased while the alcohol content, Acidity and the Sensory Qualities increased with increasing length of fermentation. From the above treatments, it is concluded that treatment T6 was found superior in respect of the parameters like Total Soluble Solids, Acidity, pH, Alcohol content, Specific gravity, Color and Appearance, Taste, Aroma and Overall acceptability. In terms of cost benefit ratio, the highest net return, Cost Benefit Ratio was also found in the same treatment.

Keywords: Cider, Pomegranate, *Saccharomyces cerevisiae*, Sugar, Fermentation

Introduction

The pomegranates are highly perishable and susceptible to weight loss and improper handling of post-harvest and storage leads to decaying. Besides from external postharvest quality, symptoms of internal quality losses of browning appear in the peel and arils kader, et al. [19]. India produces a good amount of pomegranate, so cider making could be a useful way to diversify the economy and avoid postharvest losses. Its scientific creation is less well-documented than that of other beverages of a similar nature Banjare, et al. [14].

Cider is an alcoholic beverage made from pressing and fermenting fruits like apples. Hard cider is a product that is created when the juice undergoes fermentation process and non-alcoholic cider also known as sweet cider are made into apple juice by pasteurizing it and preservatives are added to stop the fermentation process Downing [15]. The juice that is produced can be sipped as a beverage or used as a starting point for vinegar production. It

varies in color from pale yellow to dark amber rose, and the taste can be from tart to very sweet, depending on the type of fruit used.

Historically, wild yeast was used to carry out the fermentation of fruit juice. But, with the development of genetic engineering, fermented drinks are now being made using strains of *Saccharomyces cerevisiae* that have undergone genetic modification. In general, yeast starter cultures that are precisely chosen for the winemaking process based on features that have been scientifically proven complement and optimize the quality of the wine's distinctive qualities Swiegers, et al. [17]. Many different strains of *Saccharomyces cerevisiae* are currently used in the majority of cider production because they enable quick and dependable fermentation lower the danger of slow or blocked fermentation, and guard against microbial contamination Romano, et al.[18].To reduce post-harvest loss and strengthen ties between business and agriculture, food processing is crucial. By turning the excess food into goods with value additions like fermented and non-fermented beverages, the loss can be reduced. In order to create new fruit-based products with altered physio-chemical and sensory properties, particularly in terms of flavor and nutritional value, fermentation is a viable method Dudley, [16]. This experiment aimed to study the effect of different levels of yeasts on pomegranate cider and to estimate the economics of various treatments.

Treatment details

T1 (pomegranate juice 1ltr + 0.5g yeast + 500g sugar), T2 (pomegranate juice 1ltr + 1g yeast + 500g sugar), T3 (pomegranate juice 1ltr + 1.5g yeast + 500g sugar), T4 (pomegranate juice 1ltr + 2g yeast + 500g sugar), T5 (pomegranate juice 1ltr + 2.5g yeast + 500g sugar), T6 (pomegranate juice 1ltr + 3g yeast + 500g sugar), T7 (pomegranate juice 1ltr + 3.5g yeast + 500g sugar).

Materials and Methods

Cider making process includes various steps such as harvesting fruit, washing, milling and pressing, fermentation, maturation, racking off, filtering or fining, bottling, and storage. Overall cider goes through three basic stages which are essential for cider making: in the first stage, the ripe fruit is crushed; in the second stage, the juice is pressed out and third and final stage the juice may be fermented for weeks or months, and the finished cider is bottled.

Determination of physio – chemical parameters

The physio-chemical changes that the cider underwent during production and storage were examined. A digital pH meter was used to determine the product's pH, while a hand refractometer was used to measure TSS, a titrimeter was used to measure titratable acidity, and a hydrometer was used to measure alcohol content and specific gravity. The product was also examined for color and appearance, taste, aroma and overall acceptability.

Results and Discussion

Total Soluble Solids (TSS)

The gradual decrease in total soluble solids during the storage period (90 days) of pomegranate cider (Table 1) might be due to the fermentation of sugars into alcohol by the action of yeast. The general decrease in TSS was a function of time and was undoubtedly caused by the yeast fermenting the sugar. This is typical cider fermentation behavior for any alcoholic fruit juice fermentation. The decrease in TSS content of cider indicates the conversion of sugar into alcohol by yeast during fermentation. The above results are similar with the findings of Wanapu et al. [1] in rose apple cider, Walker et al. [2], Sahu et al. [3] in tendu wine, Isitua et al. [4] in banana wine. The lowest score (7.3) was observed in treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) and the maximum score (12.3) was observed in treatment T1 (Pomegranate juice 1ltr + 0.5g yeast + 500g sugar).

Alcohol content

The increase in Alcohol content of pomegranate cider with different levels of yeast during storage may possibly due to the variation in performance of the yeast to utilize the fermentable sugars affecting the ferment ability, hence the varied alcohol production .The above results are similar with the findings of Jarvis, B. [6] in apple cider, Yadav et al. [7] in Mahua wine. It is apparent from the results shown in Table 1 that with increase in fermentation time, concentration of alcohol increased. The maximum score (8.6) was observed in treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) followed by treatment T7 (Pomegranate juice 1ltr + 3.5g yeast + 500g sugar) with (8.2) and the lowest score (4.42) was observed in treatment T1 (Pomegranate juice 1ltr + 0.5g yeast + 500g sugar) during 90 days of storage.

Titratable acidity (TA)

The increase in acidity during the storage period (90days) in pomegranate cider is attributed to the production of different organic acids such as citric, malic, lactic, tartaric, oxalic and succinic acids. A similar finding was observed by Beera et al. [5] in mango wine. In Table 2 of Acidity, the maximum score (0.96) was observed in treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) followed by treatment T5 (Pomegranate juice 1ltr + 2.5g yeast + 500g sugar) with (0.94) and the lowest score (0.78) was observed in treatment T1 (Pomegranate juice 1ltr + 0.5g yeast + 500g sugar).

pH

The pH dropped gradually as the fermentation time increases. During the storage period (90 days) as shown in Table 1, the decrease in pH may possibly be due to the acids generated by bacteria. The decrease in pH with increase in acidity of cider may be due to the formation of hydrogen ions by the action of yeast. The above results are similar with the findings of Won et al. [8], Sigler et al. [9] and Castrillo et al.[10] , Akin et al.[11] in grape must. In terms of pH, the lowest score (2.88) was observed in treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) followed by T5 (Pomegranate juice 1ltr + 2.5g yeast + 500g sugar) with (3.2) and the maximum score (3.46) was observed in treatment T3 (Pomegranate juice 1ltr + 1.5g yeast + 500g sugar).

Specific gravity

As fermentation time increases specific gravity decreases gradually as shown in Table 1. The decrease in Specific gravity of pomegranate cider with different levels of yeast during storage may possibly be due to the type of yeast used in the cider production. *Saccharomyces cerevisiae* has been reported to reduce specific quality of fruit juices during fermentation. The above results are similar with the findings of Tusekwa et al. [12] and Okafor et al. [13] . In terms of Specific gravity, the lowest score (1.023) was observed in treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) followed by treatment T5 (Pomegranate juice 1ltr + 2.5g yeast + 500g sugar) with (1.029) and the maximum score was observed in treatment T1 (Pomegranate juice 1ltr + 0.5g yeast + 500g sugar) with (1.043).

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Table 1: Physio-chemical parameters of pomegranate cider during storage

Treatment symbol	Treatment details	Total Soluble Solids (° Brix)				Alcohol content (%)			Acidity (%)				pH				Specific Gravity			
		Initial	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	Initial	30 DAS	60 DAS	90 DAS	Initial	30 DAS	60 DAS	90 DAS	Initial	30 DAS	60 DAS	90 DAS
T1	Pomegranate juice (1ltr) + 0.5g(yeast) + 500g (sugar)	29.64	23.3	14.3	12.3	2.67	4.75	4.42	0.29	0.39	0.59	0.78	4.34	3.74	3.56	3.46	1.117	1.084	1.052	1.043
T2	Pomegranate juice (1ltr) + 1g(yeast) + 500g (sugar)	26.9	19.8	13.2	11.5	2.79	3.6	5.8	0.34	0.44	0.66	0.80	3.73	3.63	3.46	3.39	1.1	1.07	1.046	1.041
T3	Pomegranate juice (1ltr) + 1.5g(yeast) + 500g (sugar)	25.1	19.5	13.8	11.8	2.56	4.56	5.63	0.36	0.54	0.72	0.86	3.70	3.62	3.54	3.46	1.085	1.07	1.051	1.041
T4	Pomegranate juice (1ltr) + 2g(yeast) + 500g (sugar)	22.73	15.6	12.5	10.6	3.49	5.54	6.62	0.34	0.39	0.59	0.79	3.73	3.69	3.57	3.38	1.074	1.051	1.044	1.038
T5	Pomegranate juice (1ltr) + 2.5g(yeast) + 500g (sugar)	19.7	14.5	11.5	8.4	2.94	6.05	7.51	0.46	0.59	0.79	0.94	3.6	3.47	3.28	3.2	1.064	1.046	1.041	1.029
T6	Pomegranate juice (1ltr) + 3g(yeast) + 500g (sugar)	17.73	12.3	10.8	7.3	3.68	7.70	8.6	0.5	0.69	0.89	0.96	3.31	3.17	3.24	2.88	1.063	1.036	1.037	1.023
T7	Pomegranate juice (1ltr) + 3.5g(yeast) + 500g (sugar)	18.8	13.6	10.3	9.4	2.69	7.58	8.2	0.4	0.54	0.69	0.85	3.66	3.45	3.4	3.26	1.066	1.045	1.036	1.032
F-test		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
SE.(d)		0.502	0.219	0.219	0.219	0.16	0.249	0.259	0.033	0.065	0.058	0.036	0.136	0.075	0.09	0.071	0.013	0.01	0.005	0.004
CD at 0.5%		1.086	0.474	0.474	0.474	0.347	0.539	0.56	0.072	0.14	0.125	0.079	0.295	0.162	0.196	0.153	0.029	0.022	0.01	0.009

Table 2: Organoleptic score of pomegranate cider during storage

Treatment symbol	Treatment details	Color and Appearance			Taste			Aroma			Overall Acceptability		
		30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	30DAS	60DAS	90DAS
T1	Pomegranate juice (1ltr) + 0.5g(yeast) + 500g (sugar)	3.33	3.6	5.5	3.55	3.5	5.2	3.5	3.37	4.6	3.46	3.5	5.1
T2	Pomegranate juice (1ltr) + 1g(yeast) + 500g (sugar)	3.5	3.4	5.4	3.35	3.7	6.1	3.7	4.4	6.3	3.51	3.82	5.93
T3	Pomegranate juice (1ltr) + 1.5g(yeast) + 500g (sugar)	3.4	3.2	5.3	3.33	3.3	5.3	3.2	3.6	4.4	3.29	3.35	5
T4	Pomegranate juice (1ltr) + 2g(yeast) + 500g (sugar)	4.7	5.14	6.4	4.52	4.7	6.13	4.3	5.3	6.6	4.6	5.05	6.4
T5	Pomegranate juice (1ltr) + 2.5g(yeast) + 500g (sugar)	5.3	6.5	7.4	7.31	7.6	7.4	5.33	7.1	7.5	6.01	7.07	7.42
T6	Pomegranate juice (1ltr) + 3g(yeast) + 500g (sugar)	7.4	7.52	8.5	8.4	8.6	8.7	6.6	7.6	8.1	7.5	7.9	8.43
T7	Pomegranate juice (1ltr) + 3.5g(yeast) + 500g (sugar)	4.4	5.3	4.2	6.32	7.2	7.1	4.2	6.8	7.1	4.10	6.43	6.13
F-test		S	S	S	S	S	S	S	S	S	S	S	S
SE.(d)		0.21	0.151	0.082	0.282	0.154	0.158	0.089	0.161	0.082	0.595	0.448	0.59
CD at 0.5%		0.454	0.328	0.177	0.611	0.334	0.341	0.193	0.348	0.177	1.29	0.97	1.279

Table 3: Economics of different treatments and benefit cost ratio of pomegranate cider

Treatment No	Treatment	Total Cost(Rs)	Pomegranate Cider output (1ltr)	Selling rate(Rs)/ bottle	Gross return (Rs)	Net return (Rs)	Benefit cost ratio
T1	Pomegranate juice 1Ltr + yeast 0.5g + sugar 500g	143.20	3.00	300.00	900.00	470.40	2.09
T2	Pomegranate juice 1Ltr + yeast 1g + sugar 500g	145.45	3.00	300.00	900.00	463.65	2.06
T3	Pomegranate juice 1Ltr + yeast 1.5g + sugar 500g	147.70	3.00	350.00	1050.00	606.90	2.37
T4	Pomegranate juice 1Ltr + yeast 2g + sugar 500g	149.95	3.00	350.00	1050.00	600.15	2.33
T5	Pomegranate juice 1Ltr + yeast 2.5g + sugar 500g	152.20	3.00	450.00	1350.00	893.40	2.96
T6	Pomegranate juice 1Ltr + yeast 3g + sugar 500g	154.45	3.00	500.00	1500.00	1036.65	3.24
T7	Pomegranate juice 1Ltr + yeast 3.5g + sugar 500g	156.70	3.00	400.00	1200.00	729.90	2.55

Organoleptic evaluation

In the organoleptic evaluation such as color and appearance, taste, aroma, and overall acceptability. According to Table 2, treatment T6 (pomegranate juice 1 liter + 3 g yeast + 500 g sugar) acquired the highest sensory scores in all organoleptic characteristics measures, with scores of 8.5, 8.7, 8.1, and 8.43, indicating that the judges approved of it.

Conclusion

From the present investigation it is concluded that alcohol production increased with increasing in inoculum level. After comparing the overall result in this study, the treatment T6 was found superior in terms of physio-chemical properties i.e., total soluble solids (7.3°Brix), alcohol content (8.6%), titratable acidity (0.96%), pH (2.88), specific gravity (1.023) and overall acceptability (8.43). Similarly, the treatment T6 (Pomegranate juice 1ltr + 3g yeast + 500g sugar) showed the highest BC ratio (3.24).

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