Environment Conservation Journal, 20 (3):19-27, 2019
ISSN 0972-3099 (Print) 2278-5124 (Online)
DOI: https://doi.org/10.36953/ECJ.2019.20303
https://www.environcj.in/

High value fermented nutraceutical product from pomegranate aril and rind blends

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Received: 03.04.2019 **Revised: 24.07.2019** **Accepted: 19.08.2019**

Abstract

Nutraceutical enriched blended beverages were prepared by using different fruit combination of pomegranate, jamun, kokum and pomegranate rind powder, where the TSS (14 °B) was maintained by using raisin syrup. Fermentation was carried out for 72 hours using *Saccharomyces cerevisiae* var. *ellipsoideus* (MTCC 552) and left for ageing. Among different blending, combination Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%) recorded 28.80 mg 100-1 ascorbic acid, 4.4 % reducing sugars, 7.59 % total sugars, 414.72 mg GAE 100 ml^{-1} phenolic content, 255.78 mg GAE 100 ml^{-1} antioxidant content, 5.24 mg 100 ml^{-1} anthocyanin content, 3.80 % alcohol and rated superior by sensory panel.

Key Words: ***Pomegranate, Fermented beverage, Reducing sugars, Total sugars, Total phenols, Total antioxidants and Sensory evaluation.***

Introduction

The term "Nutraceutical", coined from two words "Nutrition" and "Pharmaceutical" in 1989 by Dr. Stephen de Felice, is defined as 'food or part of a food that provides medical or health benefits'. Nutraceuticals also refer to natural functional/medical foods or bioactive phytochemicals that have health promoting, disease preventing or medicinal properties. These nutraceuticals normally contain the required amount of vitamins, lipids, proteins, minerals *etc.* depending on their emphases (Zeisel, 1999). Nutraceuticals provide nutrients and they also contain health promoting ingredients or natural components that have a potential health benefit for the body. Pomegranate (*Punica granatum* L.) belongs to the family Punicaceae. It is native to the Iranian Plateau and has been cultivated in the Caucasus since ancient times. It is widely cultivated throughout Armenia, Azerbaijan, Iran, Afghanistan, Pakistan, Turkey, India, the drier parts of Southeast Asia, Indonesia, peninsular Malaysia, the Mediterranean and Southern Europe and Tropical Africa (La-Rue and James, 1980). It has been extensively used as a source of traditional remedy for thousands of years. The rind of the fruit and the bark of the tree are used as a traditional remedy against diarrhea, dysentery and intestinal parasites. The seeds and juice are considered a tonic for the heart and throat, and classified as a bitter-astringent (pitta or fire), it is considered a healthful counter balance to a diet high in sweet-fatty (kapha or earth) components. The astringent qualities of the flower juice, rind and tree bark are considered valuable for a variety of purposes, such as stopping nose bleeds and gum bleeds, toning skin, (after blending with mustard oil) firming-up sagging breasts and treating hemorrhoids. Its juice (of specific fruit strains) is also used as eye drops. Pomegranate peels are characterized by an interior network of membranes comprising almost 26–30 per cent of total fruit weight and are characterized by substantial amounts of phenolic compounds, including flavonoids (anthocyanins, catechins and other complex flavonoids) and hydrolyzable tannins (punicalin, pedunculagin, punicalagin, gallicandellagic acid). The technology of manufacturing wine from grapes is advanced. However, limited information is available on the production of nutraceuticals from other fruits particularly from pomegranate, jamun and kokum. It was therefore, proposed to study the preparation of blended nutraceutical beverage from

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pomegranate with raisin paste, with the above background the present study was carried out with the following objectives.

1. Standardization and development of pomegranate based fermented nutraceutical product
2. Storage stability, bio-chemical changes and organoleptic quality of prepared blended product

Materials and Method

Fully matured, disease free, pomegranate fruits, jamun, dried Kokum rind were obtained from the market and pomegranate rind powder is prepared in lab by peeling, cutting into small pieces and drying followed by grinding for the experiment. Fruits were washed thoroughly in clean water and pomegranate is peeled and fruits were extracted. Jamun fruit is mashed, dried kokum rind is rehydrated and then used for the experiment. Fruits were blended into different combination *viz.,* T1= Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%); T**2**= Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (10%); T**3**= Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (5%)**;** T4= Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%); T**5**= Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (5%); T6: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (10%); T7= Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (5%); T8: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (10%); T9=Pomegranate- 14 °B (Control) (Fig. 1). The TSS of must was maintained at 14 °B for all treatments using raisin juice. These treatments were evaluated for their bio-chemical composition during storage period and sensory qualities after three months of storage.

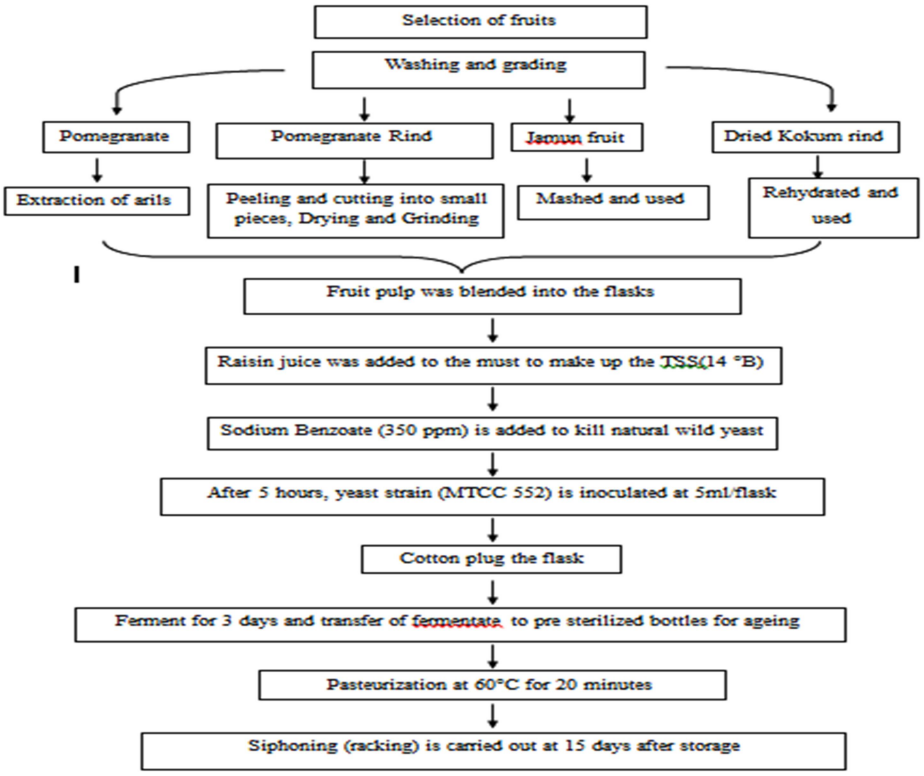

Fig.1 Flow chart of preparation of nutritionally enriched pomegranate (*Punica granatum* L.) fermented product

experiment was carried out with nine different treatments and five replications, using completely randomized design. Pomegranate blended nutraceutical beverage was analyzed for ascorbic acid, total phenols, reducing sugars, total sugars, total antioxidants, total anthocyanins and sensory evaluation for three months of storage at regular intervals. Various physico-chemical characteristics of the blended beverage were analyzed as per the standard methods.

Results and Discussion

Ascorbic acid (mg/100 ml)

The decrease in the ascorbic acid content was observed in all the treatments of pomegranate blends during the storage period of 90 days. The higher ascorbic acid content was observed in T_4 {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%)}, whereas, the lowest ascorbic acid content was recorded in T_9 (Pomegranate – 14 °B). Decrease in ascorbic acid due to increase in the temperature and as the pH goes towards acidic it will depletes the ascorbic acid content.

Similar results obtained by Kalra and Tandon (1984) were they reported decrease in TSS and ascorbic acid in storage of mango and guava juice. A study conducted by Brock *et al.* (1998) revealed that, ascorbic acid is very sensitive to thermal and pressure temperatures (Table 4).

Reducing Sugars (%)

Reducing sugars was found to decrease during the storage period. Fermented nutraceutical of Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%) - T_3 was found to be significant with higher reducing sugar content of 4.40 per cent. The lowest reducing sugar content of 3.23 per cent was observed in T_9 - Pomegranate - 14°B. As the storage period advanced the reducing sugar content decreased, these results are in agreement with the results of Matapathi (2002) who studied the screening of wine yeasts and pomegranate cultivars for wine production and found reduction in per cent residual sugars content of pomegranate wine during 60 days of storage. Subba Rao (1973) with cashew apple wine, Bardiya *et al.* (1974) in Guava wine and Kerni and Shant (1984) in Kashmir apple wine.

Total Sugars (%)

Bravo and Inigo (1989) who reported to notice that during ageing total sugars decreased and also Olasupo and Obayori (2003) monitored the process for changes in sugar content for 24 hr interval during the 5 days of fermentation and the sugar content was decreased significantly during all stage of storage.

Similar results were reported and they were in similarity with the earlier workers. A decreasing trend of total sugars was observed in the blended beverages. Treatment T_3 {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)}was found to be significant with higher sugars of 7.59 per cent. The lowest was observed in T_9 - Pomegranate - 14°B (Control) of 6.28 per cent.

Phenols (mg GAE 100 ml^{-1})

The decreasing trend in the phenolic content was observed during the storage time. The phenolic content (414.72 mg GAE 100 ml^{-1}) was recorded highest in the treatment T_7 {Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (5%)}. There was significant difference between the treatments with respect to phenols. The lowest level of phenols (159.85 mg GAE 100 ml^{-1}) was observed in the treatment T_9 – (Pomegranate 14 °B), this might be due to high rate of fermentation releasing higher amounts of phenols and tannins.

The results are on par with the results of Augustin (1987) where he found higher phenolic content in cashew apple wine. Various proteins including yeast cells become coated with tannin making such aggregates to settled down and give clarity to the wine. This result were supported by the study of Attri *et al*. (2009), they estimated the total phenols content in cashew apple wine was 152.08 mg^{-1} after 10 days after fermentations.

Antioxidants (mg GAE 100 g^{-1})

Kapoor and Ranote (2015) in their study of antioxidant potentials and quality of blended pear and jamun juice revealed that jamun pulp supplementation enhanced the bioactive composition of pear juice in terms of increased ascorbic acid, anthocyanins, total phenols and antioxidant activity decreased by 20.52 per cent, during storage period of six months resulted in reduction of bioactive components and had a

Table 1: Proximate estimation of fruits

Sl. No.	Parameters	Average values		
		Pomegranate	Jamun	Kokum
1	TSS (°B)	14.50	12.00	9.50
2	pH	3.11	3.70	2.54
3	Acidity (%)	0.60	0.40	0.85
4	Ascorbic acid (mg $100g^{-1}$)	4.20	18.00	12.32
5	Reducing sugars (%)	8.65	8.01	1.32
6	Total sugars (%)	12.80	11.80	5.08
7	Total phenols (mg $100ml^{-1}$)	745.0	196	31.5

Table 2. Effect of different treatments on ascorbic acid (mg 100 ml^{-1}) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	57.60	51.20	46.40	40.00	35.20	30.40	27.20
T_2	62.40	56.00	49.60	43.20	38.40	35.20	32.00
T_3	59.20	52.80	48.00	41.60	36.80	32.00	28.80
T_4	65.60	59.20	52.80	46.40	40.00	36.80	33.60
T_5	46.40	40.00	33.60	28.80	25.60	22.40	19.20
T_6	52.80	48.00	43.20	36.80	32.00	28.80	24.00
T_7	49.60	43.20	36.80	30.40	27.20	24.00	20.80
T_8	56.00	49.60	44.80	40.00	33.60	28.80	25.60
T_9	40.00	33.60	27.20	22.40	17.60	14.40	11.20
CD	16.600	15.281	13.054	15.350	14.648	14.720	14.791
SEm ±	4.316	3.973	3.394	3.991	3.809	3.827	3.846
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 3. Effect of different treatments on reducing sugars (%) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	4.28	4.25	4.20	4.14	4.11	4.08	4.03
T_2	4.11	4.07	4.01	3.97	3.94	3.91	3.88
T_3	4.66	4.61	4.57	4.52	4.49	4.44	4.40
T_4	4.45	4.40	4.34	4.29	4.25	4.21	4.17
T_5	3.73	3.69	3.65	3.61	3.57	3.54	3.50
T_6	3.59	3.55	3.51	3.47	3.44	3.40	3.37
T_7	3.97	3.93	3.89	3.85	3.81	3.77	3.72
T_8	3.81	3.78	3.74	3.70	3.66	3.61	3.57
T_9	3.47	3.43	3.39	3.35	3.31	3.27	3.23
CD	0.060	0.031	0.037	0.036	0.025	0.037	0.026
SEm ±	0.016	0.008	0.010	0.009	0.006	0.010	0.007
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 4. Effect of different treatments on total sugars (%) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	7.54	7.49	7.44	7.35	7.30	7.24	7.19
T_2	7.34	7.27	7.20	7.14	7.10	7.06	7.01
T_3	7.92	7.87	7.81	7.75	7.70	7.64	7.59
T_4	7.71	7.65	7.57	7.50	7.45	7.40	7.34
T_5	6.97	6.89	6.83	6.75	6.69	6.64	6.59
T_6	6.89	6.80	6.74	6.67	6.60	6.52	6.44
T_7	7.20	7.11	7.03	6.98	6.92	6.87	6.83
T_8	7.10	7.01	6.94	6.86	6.79	6.72	6.67
T_9	6.79	6.70	6.61	6.53	6.44	6.35	6.28
CD	0.034	0.041	0.025	0.030	0.027	0.036	0.115
SEm ±	0.009	0.011	0.006	0.008	0.007	0.009	0.030
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 5. Effect of different treatments on phenols (mg gallic acid equivalents 100 ml^{-1}) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	748.54	645.84	448.82	380.11	323.48	282.52	224.26
T_2	741.38	590.44	504.22	398.34	363.52	343.04	288.36
T_3	632.01	507.90	450.56	414.82	405.09	312.73	277.91
T_4	577.74	479.03	446.36	384.82	358.50	343.14	304.64
T_5	774.35	651.26	466.02	437.25	405.71	382.26	359.53
T_6	816.84	654.64	650.24	507.60	418.71	400.08	381.85
T_7	942.28	753.66	631.60	612.86	512.41	466.53	414.72
T_8	879.41	804.86	637.95	538.21	505.14	414.82	395.26
T_9	363.01	345.09	302.90	255.59	233.27	188.01	159.85
CD	51.791	17.534	67.628	1.079	0.851	1.203	1.661
SEm ±	13.466	4.559	17.584	0.280	0.221	0.313	0.432
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 6. Effect of different treatments on antioxidants (mg AAE 100 ml^{-1}) content of nutraceutical enriched blended beverages during storage.

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	398.87	385.93	340.60	307.28	261.99	246.37	232.60
T_2	398.24	374.28	340.88	313.45	284.85	263.84	246.69
T_3	472.88	432.98	387.62	336.35	299.25	270.18	245.03
T_4	444.78	409.53	365.11	328.84	303.62	277.49	255.78
T_5	419.80	395.49	374.08	352.36	298.27	235.20	201.09
T_6	412.01	378.45	346.70	303.07	281.94	255.81	224.42
T_7	414.73	382.42	342.76	301.38	258.14	231.03	210.10
T_8	399.50	383.92	346.78	315.46	280.21	257.78	229.06
T_9	386.99	336.47	305.47	268.99	211.20	207.74	200.58
CD	0.257	0.305	0.431	0.355	0.484	4.596	0.353
SEm ±	0.067	0.079	0.112	0.092	0.126	1.195	0.092
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 7. Effect of different treatments on anthocyanin (mg 100 ml^{-1}) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	10.61	9.52	8.49	6.14	5.12	4.31	3.84
T_2	10.04	8.71	7.91	5.92	4.88	4.07	3.62
T_3	11.52	10.89	8.73	7.80	7.05	6.02	5.11
T_4	12.50	11.15	8.77	8.03	6.78	6.00	5.24
T_5	9.31	8.80	7.02	6.37	5.68	3.86	3.33
T_6	8.54	7.28	6.67	6.19	5.57	4.51	2.87
T_7	9.87	7.41	6.62	5.97	5.28	4.70	4.23
T_8	10.10	8.94	7.11	6.55	6.19	5.59	4.53
T_9	5.68	4.34	3.82	3.16	2.53	1.59	1.25
CD	0.012	0.010	0.010	0.013	0.043	0.009	0.011
SEm ±	0.003	0.003	0.002	0.003	0.011	0.002	0.003
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Table 8. Effect of different treatments on alcohol (%) content of nutraceutical enriched blended beverages during storage

Treatments	0 Days	15 Days	30 Days	45 Days	60 Days	75 Days	90 Days
T_1	3.41	3.54	3.68	3.80	3.88	3.96	4.04
T_2	3.47	3.60	3.66	3.74	3.86	3.94	4.06
T_3	3.16	3.28	3.40	3.51	3.60	3.68	3.80
T_4	3.29	3.43	3.54	3.60	3.71	3.82	3.88
T_5	3.62	3.71	3.78	3.86	3.98	4.06	4.12
T_6	3.68	3.80	3.94	4.02	4.10	4.16	4.22
T_7	3.51	3.62	3.74	3.82	3.94	4.00	4.08
T_8	3.55	3.64	3.76	3.84	3.92	4.02	4.10
T_9	3.76	3.84	3.92	4.00	4.10	4.18	4.26
CD	0.029	0.021	0.031	0.021	0.031	0.027	0.028
SEm ±	0.007	0.006	0.008	0.005	0.008	0.007	0.007
F test	**	**	**	**	**	**	**

** Significant at 1% level NS - Non Significant

Treatment details

T_1: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)
T_2: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (10%)
T_3: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (5%)
T_4: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%)
T_5: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (5%)
T_6: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (10%)
T_7: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (5%)
T_8: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (10%)
T_9 : Pomegranate- 14^0 B (Control)

variable effect on physico-chemical characteristics of the blended pear-jamun juice. Similarly in the present investigation the decreasing trend in the antioxidant content was observed during storage period. The antioxidant content of 255.78 mg GAE 100 ml^{-1} was found highest in the treatment T_4 {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%)}. The lowest level of antioxidant of 200.58 mg GAE 100 $ml^{-1}$was observed in the treatment T_9 (Pomegranate – 14°B). Vitamin - C is directly correlated with antioxidant content during the storage period Vitamin - C starts decreasing which is directly proportional to the antioxidant content of the fermented nutraceutical.

Anthocyanin (mg 100 ml^{-1})

The decreasing trend in the anthocyanin content was observed in storage period. The anthocyanin content of 5.24 mg 100 ml^{-1} was found highest in the treatment T_4 {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%)}, Whereas the lowest level of anthocyanin content of 1.25 mg 100 ml^{-1} was observed in the treatment T_9 {Pomegranate - 14°B (Control)}. Decrease in the anthocyanin is due to the oxidation to brown pigments caused by Poly Phenyl Oxidase and it is directly correlated with the ascorbic acid.

Similarly Rommel *et al.,* 1990 reported that during fermentation, anthocyanin pigment is partially degraded with a total loss of at least 50 per cent after storage. Cyanidin-3-glucoside was the most unstable anthocyanin which disappearing completely during fermentation while cyanidine 3--sorphoroside was the most stable pigment.

Alcohol (%)

Chikkasubbanna *et al*. (1990) reported that the alcohol percent of the grape wine increased due to a decrease in total soluble sugars due to the activity of yeast during fermentation, Adsule *et al.* (1992) estimated the alcohol content in pomegranate wine and reported that upon incubation alcohol content increased which was observed to be 6.6 per cent and Sapna *et al*. (2002) obtained an alcohol content of 6.57 to 6.75 per cent in Japanese wine, coriander wine had 7.05 to 7.37 per cent in the thirds and after nine weeks of storage. The increase in alcohol content was due to the complete conversion of sugars to alcohol.

In the present investigation similar results were obtained which were in agreement with the results of previous workers. The increasing trend in the alcohol content was observed in storage period. The alcohol content of 4.26 per cent was found to be significantly highest in the treatment T_9 (Pomegranate – 14 °B). The lowest alcohol percentage of 3.80 was observed in the treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)}.

Organoleptic Evaluation

The quality of pomegranate nutraceutical samples were assessed by organoleptic or sensory evaluation using hedonic scale. It was wine was evaluated based on the appearance, colour, body, taste, flavour for its overall quality and the score obtained by sensory evaluation are discussed here under.

Taste

The highest taste score (8.3) was recorded in the treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)} having good attractive colour, taste and it was acceptable when compared to all other treatment and it was found superior with respect to taste and also these results are also agreed with the findings of Sahu *et al*. (2006), Kotecha *et al*. (1995).

Colour

The fermented nutraceutical was attractive and acceptable in treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)} was recorded highest sensory score (8.5) with respect to colour. These results are similar to the findings of Patil (1994).

Sweetness

Maximum score (8.6) for sweetness was recorded in the Treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)}and this may be due to higher sugar concentration in the treatment and these results are on par with the results of Kulkarni *et al.* (1980). Higher levels of sugar may be due to abrupt arresting of fermentation.

Astringency

Moderate astringency was found in Treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)}, this might be due to higher sugar concentration would have reduced the astringency of fermented

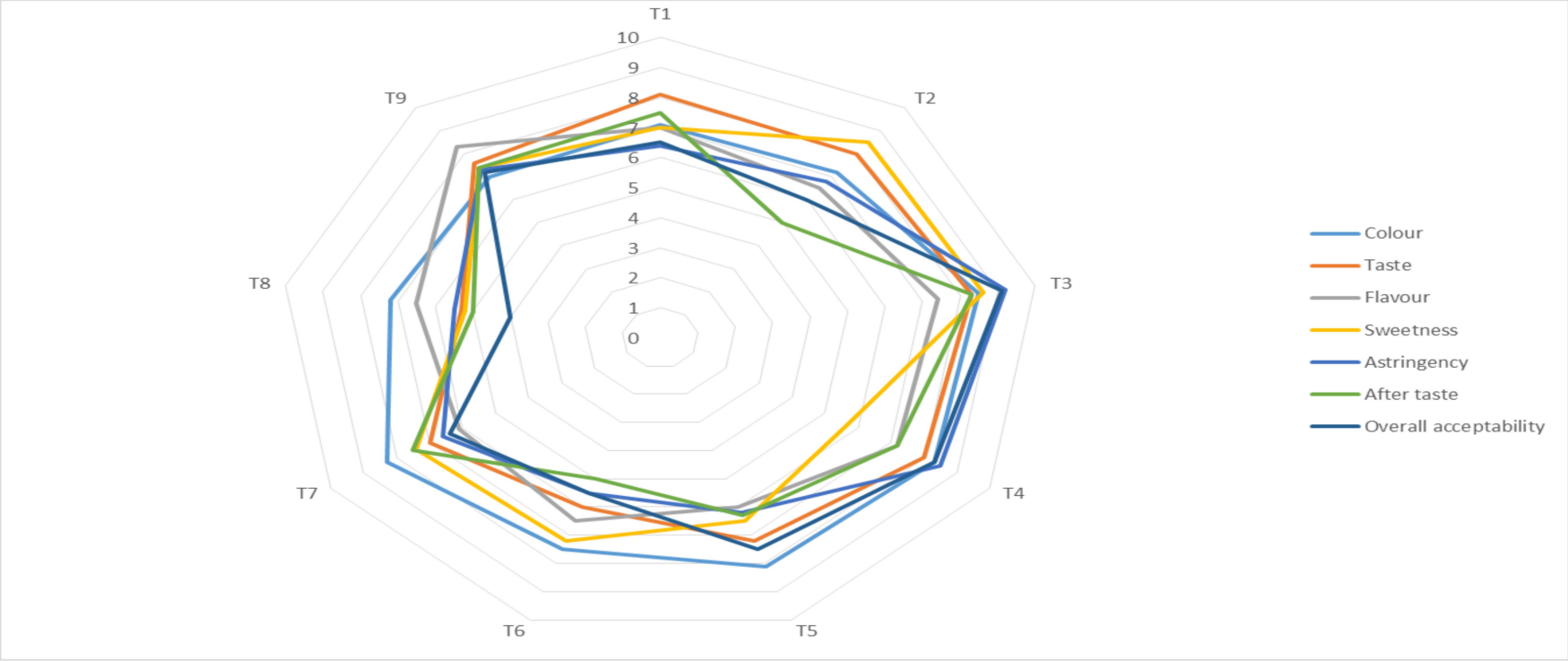

Fig.2 Sensory evaluation of nutraceutical enriched blended beverages

T1: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)
T2: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (10%)
T3: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (5%)
T4: Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (30%) + Kokum (10%)
T5: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (5%)
T6: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (20%) + Kokum (10%)
T7: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (5%)
T8: Pomegranate aril (50%) + Pomegranate rind powder (2%) + Jamun pulp (30%) + Kokum (10%)
T9: Pomegranate- 140 B (Control)

nutraceutical and similar results were also obtained by Gautam and Chundawat (1998).

Overall Acceptability

Overall acceptability was good in Treatment T_3 - {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)}. This may be due to the presence of correct sweetness, moderate astringency, colour and appearance and these results were on par with the findings of Gautam and Chundawat (1998), Kulkarni *et al.* (1980), Sahu*et al*. (2006), Kotecha*et al*. (1995) and Patil (1994).

Conclusion

Overall from the present investigation, the fermented nutraceutical with the combination of {Pomegranate aril (50%) + Pomegranate rind powder (1%) + Jamun pulp (20%) + Kokum (5%)} was found to be the best with highest anthocyanin, antioxidants, ascorbic acid, TSS, reducing sugars, non-reducing sugars, total sugars and phenols with lower alcohol and titrable acidity level and it was highly accepted by the sensory panel.

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