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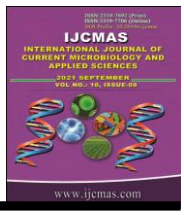

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Study on Preparation of Pomegranate Jam Fortified with Extracts of Some Horticultural Plants

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A B S T R A C T

Pomegranate fruits are very beneficial to us and if some processed thing can be developed from it, further enhanced with extracts of important horticultural plants than it can be additionally more useful to us. Therefore, keeping this thing in mind, the work was undertaken. In the present experiment fortified pomegranate jam was prepared and analyzed. The preparation of jam, by adding extract of beneficial horticultural plants along with specified concentration of pectin and sodium benzoate was done with continuous stirring while heating. The extracts used for fortification of the jam were taken from mint, coriander, green tea, coffee and basil. Overall there were six treatments including the control. After preparation of the fortified pomegranate jam, they were stored in glass bottle in refrigerated condition. All the treatments were replicated three times and Completely Randomized Design was used for statistical analysis. Attributes were studied in the laboratory at different days of storage interval. From the total experiment it was obtained that the pomegranate jam fortified with coriander seed and basil extract were the best which was followed by green tea extract as fortifying agent, as they showed good results.

Keywords

Pomegranate, jam, fortification, storage, attributes

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Introduction

The fruit of pomegranate has established itself as an encouraging intake and there are many reasons to support this statement as the edible juicy arils are very lucrative and invigorating and not only this the remedial and therapeutic properties of it, further makes it important. The fruit in one way or the other is very beneficial and important to us in multiple aspects. It has been found that the crop in particular is having tremendous potential against diarrhea, numbness and Hansen's disease. The portion of the fruit which is selected or extracted out for consumption is a significant reserve of dietary valuables and also rich in various neutraceutical qualities (Fadavi *et al.*, 2006).

Jam is one such product which can be carved out of this fruit containing good amount of beneficial properties and not only this it is also a very efficient and easy way out by which the mentioned fruit can be conserved for a considerable period and also the mislaying after harvest can be contained (Momin and Thakre, 2015). Today fortified food are in great demand as these type of edible entities are enriched with various supplements which helps in elevating their worth and also becomes very good for our health. Food fortification further can be defined as a process where a particular food is being appended with an exclusive or multiple supplements which may or may not be previously available with that food. The aim of it is that, it helps in eradicating nutritional insufficiency in a targeted mass of population or a population at large (Codex Alimentarius, 1991; Liyange and Hettiarachchi, 2011).

Thus if foods having intermediate moisture content which are additionally fortified with various nutrients, if consumed in a proper way would definitely help us in solving issues related to our health. Moreover if fortification is done with extracts of some serviceable plants than it will add icing to the cake. Advantageous plants are well known across the globe for their good source of antioxidants and for their welfare in curing stomach related problems, elevating neural activities, increases liveliness and reduce chances of diabetes. The consumption of fortified foods and jams those are enriched with plant extracts has been reported to have beneficial effects on human health. So keeping all of these in mind the research was undertaken to develop a pomegranate jam by fortifying it with the extract of the horticultural plants and to judge the final outcome depending upon different parameters.

Food fortification (FF) is defined as the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups.

Materials and Methods

The fresh and fully matured pomegranate fruit (variety-Kabul) were procured from the commercial enterprise, the research work was carried out in the laboratory of Institute of Agricultural Science, Department of Horticulture, University of Calcutta in the academic year of 2019-2020. The fruits were washed properly under running water and the arils were separated from the rind. Then the arils were macerated in a juicer where the seeds got separated and the juice was collected. Also, to make the juice more purified and clear it was passed through a soft clean muslin cloth to obtain more crystal-clear juice. Then the juice was subjected to heat for the preparation of jam through induction heating method, by adding extract of horticultural plants, along with specified concentration of pectin and sodium benzoate with continuous stirring while heating. Finally, the jam was prepared and was kept in sterilized glass jars and stored in refrigerated condition thereby.

The treatments used in the study were as follows: T_1- Juice 90ml + 15% pectin + 10ml Mint extract + 100ppm of sodium benzoate, T_2- Juice 90ml + 15% pectin+ 10ml Coriander extract (10gm Coriander Seeds+ 10gm Coriander Leaf) +100ppm of sodium benzoate, T_3- Juice 90ml+15% pectin+10ml Green Tea extract+100ppm of sodium benzoate, T_4- Juice 90ml+15% pectin+10ml Coffee extract+100ppm of sodium benzoate, T_5- Juice 90ml+15% pectin+10ml Basil extract+100ppm of sodium benzoate, T_6- Juice 90ml+15% pectin+100ppm of sodium benzoate. The observations were taken at 0, 20

and 30 days of storage. Parameters which were selected for the study were total sugar (Rangana, 2003), reducing sugar (Rangana, 2003), total phenolic content (Singleton *et al.*, 1999), appearance quality (Peryam & Girardot, 1952, Peryam & Pilgrim, 1957) and total fungal count (Allen, 1953). All the treatments were replicated three times with Completely Randomized Design (Gomez and Gomez, 1984). Also the help of online software was taken for the analysis (Sheoran *et al.*, 1984).

Results and Discussion

Total Sugar

The total sugar of the pomegranate jam enhanced with plant extracts at different days of storage is shown in Table 1. From the analysis we can say that there is an increase in the Total Sugar content of the Jam at 0 days and 30 days interval. At the 1st segment of 0 DAS T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) showed the least accumulation of 31.54% which was followed by T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) showing a content of 39.89%. Furthermore at 30 days interval the minimum deposition in the content of sugar was seen in T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) followed by T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate), T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm of sodium benzoate), T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate) showed the highest gain of 49.04%.

Reducing Sugar

Table 2 shows the value of Reducing Sugar of the pomegranate fortified jam at different interval during the storage period. As like as the Total sugar content here also an increasing pattern in the Reducing Sugar percentage was seen at different intervals. At 0days of storage T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) was with the least content and T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate) was with the highest amount. An increasing trend further continued in 30 days where T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) was with the least amount of 29.84%, which was followed by T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) showing a content of 30.63%. In T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate) the concentration ranged at highest of 43.07%.

Phenols

The total phenolic content of the pomegranate jam mixed with extracts of different important plant constituents at different days of storage is shown in Table 3. It can be concluded from the table that the phenolic content deteriorated at the storage intervals. Here T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) demonstrated the maximum content of 24.80% which was followed by T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate), T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate), T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm of sodium benzoate),T_4 (Juice 90ml+15% of juice pectin+10ml Coffee extract+100ppm of sodium benzoate), T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate).

Thereafter at 30 days interval the highest amount of phenolic content was demonstrated by T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate)

which was followed by T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate), T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate), T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm of sodium benzoate),T_4 (Juice 90ml+15% of juice pectin+10ml Coffee extract+100ppm of sodium benzoate), T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate).

Appearance Quality

Appearance quality of the fortified pomegranate jam at different days of storage is shown in Table 4.

This was extracted by a 9-point hedonic scale. On 0 days interval T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) and T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) recorded the highest score of 8.67.

Least value of 8 was seen for T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate), T_4 (Juice 90ml+15% of juice pectin+10ml Coffee extract+100ppm of sodium benzoate) and T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate). Likewise, on 30 days interval T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) recorded the highest score of 6.33.

It was followed by T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm of sodium benzoate) and T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm of sodium benzoate) at a score of 6.00. T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate) showed the least value of 5.33.

Fungal count

Table 5- shows the total fungal count of the pomegranate jam enhanced functionally by mixing extracts of different important plants at varied days of storage. At 20 days interval T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) was recorded with 0 fungal colony. Whereas 0.67 colonies each were found for T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate) and T_3 (Juice 90ml+15% of juice pectin+10ml Green tea extract+100ppm sodium benzoate). T_4 (Juice 90ml+15% of juice pectin+10ml Coffee extract+100ppm sodium benzoate) was recorded with 1 fungal colony. For T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm sodium benzoate) 1.33 fungal colonies were observed. T_6 (Juice 90ml+15% of juice pectin+100ppm of sodium benzoate) recorded 1.67 number of fungal colonies. At 30 days interval T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) and T_4 (Juice 90ml+15% of juice pectin+10ml Coffee extract+100ppm of sodium benzoate) was recorded with 0 colonies and maximum number of fungal colonies were seen for T_1 (Juice 90ml+15% of juice pectin+10ml Mint extract+100ppm of sodium benzoate) and T_6 (Juice 90ml+155 of juice pectin+100ppm of sodium benzoate) reporting 2 and 3 fungal colonies respectively.

Different parameters were analysed during the storage intervals of pomegranate jam fortified with extracts of different horticultural plant constituents. It was found that the Total sugar and reducing sugar increased during the period of the study and these findings were as per to the previous research carried out by Pindayo (2016), in his experiment based on development of protein fortified value-added papaya jam.

Table.1 Total Sugar (%) of fortified pomegranate jam at different days of storage

Treatments	0 DAS	30 DAS
T_1	33.15	43.45
T_2	41.67	46.30
T_3	31.89	34.58
T_4	42.61	46.80
T_5	31.54	38.47
T_6	42.61	49.04
CD	**7.914**	**3.710**
Sem±	**2.540**	**1.191**

Table.2 Reducing Sugar (%) of fortified pomegranate jam at different days of storage

Treatments	0 DAS	30 DAS
T_1	27.51	35.81
T_2	32.64	42.05
T_3	26.53	29.84
T_4	33.05	42.05
T_5	25.88	30.06
T_6	33.05	43.07
CD	**0.316**	**6.309**
Sem±	**0.101**	**2.025**

Table.3 Total phenolic content (mgGAE/g) of fortified pomegranate jam at different days of storage

Treatments	0 DAS	30 DAS
T_1	16.44	9.35
T_2	18.20	9.54
T_3	24.80	10.06
T_4	15.19	9.25
T_5	22.01	17.57
T_6	14.80	8.21
CD	**6.428**	**3.026**
Sem±	**2.063**	**0.971**

Table.4 Appearance quality of fortified pomegranate jam at different days of storage

Treatments	0 DAS	30 DAS
T_1	08.33	06.00
T_2	08.00	05.67
T_3	08.67	06.00
T_4	08.33	05.67
T_5	08.67	06.33
T_6	08.00	05.33
CD	**N/A**	**N/A**
Sem±	**0.491**	**0.360**

Table.5 Total fungal count (x 10^2cfu/g) of fortified pomegranate jam at different days of storage

Treatments	0 DAS	20 DAS	30 DAS
T_1	00.00	01.33	02.00
T_2		00.67	01.00
T_3		00.67	01.67
T_4		01.00	00.00
T_5		00.00	00.00
T_6		01.67	03.00
CD	-	**N/A**	**N/A**
Sem±	-	**00.892**	**01.381**

The phenolic concentrations on the contrary reduced as compared to the initial day of processing in both the storage segment of analysis. With respect to the phenol, similar observation was again recorded by Pindayo in 2016.

Furthermore, Shokry *et al.,* (2018) also revealed similar kind of results on pomegranate jam where control had the least concentrations. For appearance quality, generally a 9-point hedonic scale was taken which was also used in the previous work done by Das *et al.,* (2019).

From the study it was obtained that T_3 (Juice 90ml+15% of juice pectin+10ml Green Tea extract+100ppm of sodium benzoate) showed the least accumulation of total sugar and reducing sugar concentrations. Phenolic concentration reduced and it was observed that at 30days T_5 (Juice 90ml +15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) was able to withhold the maximum amount. With respect to the appearance score T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) demonstrated the best result. And finally, for Fungal count T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate) at the end of storage period was without any colony development. Thus overall, we can say that treatments T_2 (Juice 90ml+15% of juice pectin+10ml Coriander extract +100ppm of sodium benzoate) and T_5 (Juice 90ml+15% of juice pectin+10ml Basil extract+100ppm of sodium benzoate) followed by T_3 (Juice 90ml+15% of juice pectin+10ml Green Tea extract+100ppm of sodium benzoate) are some of the best combinations which helped in maintaining the quality of the jam throughout the storage period.

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