

Development of Nutritionally Enhanced Pomegranate Peel Powder by Blending with Certain Spices

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ABSTRACT

Post-harvest processing can be developed from the peel and enhanced by mixing of certain spices which will add more benefits and minimize the wastes produced. So, we took upon the research where pomegranate peel powder was mixed with different spices like black pepper powder, turmeric powder, ginger powder, clove powder, onion powder in a ratio of 90:10 (T1 to T5) and T6 was 90g of pomegranate peel powder as control respectively. The mixtures were preserved in glass bottle. Analysis of various parameters like total sugar, ascorbic acid, antioxidant, phenol, appearance quality, fungal count was done at 0 to 40 days interval. These treatments were replicated 3 times and Completely Randomized Design was used for statistical analysis. Lastly from the study pomegranate peel powder blended with turmeric

powder (T2) and pomegranate peel powder blended with onion powder (T5) were found suitable.

Keywords Pomegranate, Peel powder, Spices, Blending, Storage.

INTRODUCTION

Wastage obtained out of fruits contains good amount of functional compounds. Recycling by product or processing waste is extremely appreciated from environmental point of view as well as due to the additional health benefits derived from the active compounds present in them. This product may be used as such or after further value added. Waste recycling is emerging as one of the important areas in research for achieving efficiency in utilization of all the raw materials or inputs so as to reduce the cost of production. One such declined substance from industries of juice processing is the pomegranate peel, which as per earlier reports have significant important components like phenols, tannins and high flavonoids (Mirdehghan and Rahemi 2007).

Therefore, the peel of the pomegranate could be used as substrate for the production of nutritionally valuable and biologically active components that could find several applications as functional food ingredients, food additives, nutraceuticals and supplements and in phenolic-rich diets. Several scientific studies have confirmed pomegranate's biological activities and medicinal effects of the edible part of

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the fruit, but very few information exist about the bioactivity of pomegranate by-products. Therefore, more research is required to be carried out, in this particular area. Therefore, keeping in mind, the beneficial attributes of the pomegranate peel, the study was undertaken to utilize the peel waste by converting it into peel powder and further more blending it with some spices, so that the inherent functional property can additionally be enriched.

MATERIALS AND METHODS

The present scrutiny was carried out in the Department of Horticulture, Institute of Agricultural Science, University of Calcutta in the academic year 2019-2020. Pomegranate fruit with good color were brought from commercial enterprise. Fruits were washed in tap water and the seed were separated from the peel manually. The peel was then cut into small pieces by using stainless sharp knife and shade dried in ambient condition of the laboratory. Then the peels thereafter were subjected to dehydration in a hot air oven at 80°C for 10 hrs. The dried pomegranate peel was crumbled by a grinder and then the powder was passed through 20mm sieve size. For preparation of the treatment's spices like black pepper, turmeric, ginger clove and onion were used. The fresh ginger, onion, turmeric was sliced up to 2 to 3 mm with knife and dried in an oven dryer at 75°-80°C for 10 hrs up to 10- 12% moisture content. After cooling at room temperature, the dried ginger, onion and turmeric slices were grounded into powder in a blender. Dried black pepper and cloves bought from the market followed by crushing in the laboratory and passed through 20 mm. sieve to obtain fine powder.

Finally the treatment used in the study were: T1: 90g pomegranate peel powder+10g black pepper powder, T2: 90g pomegranate peel powder+10g turmeric powder, T3: 90g pomegranate peel powder+10g ginger powder, T4: 90g pomegranate peel powder+10g clove powder, T5: 90g pomegranate peel powder+ 10g onion powder, T6: 90g pomegranate peel powder (control). The enhanced pomegranate peel powder blended with spices were then stored in refrigerated conditions. The observation was taken at 0 and 40 days after storage (DAS). Parameters which were taken for the study were Total sugar (Rangana,

2003), Ascorbic acid (Rangana 2003), Antioxidant (Brand – Williams *et al.*1995), Total Phenolic Content (Singleton *et al.*1999), Appearance quality (Peryam and Girardot 1952, Peyram and Pilgrim 1957), Fungal count (Allen 1953). Layout of the experiment was one factorial Completely Randomized Design (CRD) with 3 replications, by adopting the statistical procedures (Gomez and Gomez 1984, Sheoran *et al.* 1998).

RESULTS AND DISCUSSION

Total sugar

The value of total sugar (%) of pomegranate peel powder blended with different spices during the storage is shown in Table 1. At 0 DAS it was found that T2 (90g pomegranate peel powder+ 10g turmeric powder) recorded the highest percentage of total sugar concentration which was followed by near about similar value by T5 (90g pomegranate peel powder+ 10g onion powder), T1 (90g pomegranate peel powder+10g black pepper powder) and T3 (90g pomegranate peel powder+10g ginger powder). Later on, when analysis was performed at 40 DAS of storage, it was observed that the total sugar concentration amongst the treatments further decreased as compared to the 0 days of storage analysis. Here it was found that T2 (90g pomegranate peel powder+10g turmeric powder) and T5 (90g pomegranate peel powder+10g onion powder) were recorded with almost similar highest concentration of total sugar and the lowest value of 23.16% was seen for T6 (90g pomegranate peel powder).

Ascorbic acid

Table 2 reveals the ascorbic acid amount of pomegranate peel powder blended with different spices

Table 1. Total sugar (%) of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	37.04	27.48
T2	38.93	28.88
T3	37.46	27.76
T4	33.65	23.71
T5	37.65	28.64
T6	30.59	23.16
CD	3.971	4.202
Sem±	1.28	1.349

Table 2. Ascorbic acid (%) of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	83.17	69.83
T2	85.00	72.67
T3	86.33	73.67
T4	82.17	70.50
T5	92.83	73.00
T6	81.60	67.17
CD	7.325	N/A
Sem±	2.351	4.914

during the storage. From the analysis it was observed that there was a throughout declination in the concentration of the ascorbic acid among the treatments. During the first segment of 0 DAS highest concentration was seen of 92.83% in T5 (90g pomegranate peel powder+10gm onion powder) which was followed by T3 (90g pomegranate peel powder+10g ginger powder), T2 (90g pomegranate peel powder+10g turmeric powder), T1 (90gm pomegranate peel powder+10g black pepper powder), T4 (90g pomegranate peel powder+10g clove powder) and T6 (90g pomegranate peel powder). But later on, at 40 DAS interval T3 (90g pomegranate peel powder+10g ginger powder) depicted the highest value of ascorbic acid followed by T5 (90g pomegranate peel powder+10g onion powder), T2 (90g pomegranate peel powder+10g turmeric powder), T4 (90g pomegranate peel powder+10g clove powder), T1 (90g pomegranate peel powder+10g black pepper powder), T6 (90g pomegranate peel powder).

Antioxidant

The antioxidant activity (percent inhibition of DPPH) of pomegranate peel powder blended with different spices during the storage is shown in Table 3. It was seen that the antioxidant activity declined during both the segments of the storage analysis. At the first 0 DAS interval highest antioxidant activity (percent inhibition of DPPH) was shown by T2 (90g pomegranate peel powder+10g turmeric powder) of 43.08%. This was immediately followed by T5 (90g pomegranate peel powder+ 10g onion powder) showing a value of 41.28% T6 (90g pomegranate peel powder) was in the lower side showing a value of 36.87%. At 40 DAS of storage the maximum with holding of antioxidant percentage was seen

Table 3. Antioxidant (percent inhibition of DPPH) of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	38.25	33.83
T2	43.08	34.09
T3	39.35	34.37
T4	36.98	32.89
T5	41.28	35.72
T6	36.87	32.45
CD	4.370	1.925
Sem±	1.403	0.618

by T5 (90g pomegranate peel powder+ 10g onion powder) with 35.72% which was followed by T3 (90g pomegranate peel powder+10g ginger powder) showing amount of 34.37% and there after T2 (90g pomegranate peel powder+10g turmeric powder) was there with a concentration of 34.09%.

Total phenolic content

Table 4 depicts the total phenolic content (mg GAE/g) of pomegranate peel powder blended with different spices during the storage. At 0 DAS interval highest phenolic concentration was maintained by T2 (90g pomegranate peel powder+10g turmeric powder) at 75.85 (mg GAE/g). Control T6 (90g pomegranate peel powder) showed the least figures of 66.97mg GAE/g. A similar kind of treatment was observed at 40 DAS of storage where the highest concentration was recorded by T2 (90g pomegranate peel powder+10g turmeric powder), followed by T5 (90g pomegranate peel powder+ 10g onion powder), T3 (90g pomegranate peel powder+10g ginger powder), T1 (90g pomegranate peel powder+10g black pepper powder) and control T6 (90g pomegranate peel powder) remained in the lower side of 52.21 mg GAE/g.

Table 4. Total phenolic content (mg GAE/g) of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	71.50	59.80
T2	75.85	66.20
T3	72.20	62.65
T4	69.18	55.55
T5	74.23	66.00
T6	66.97	52.21
CD	1.861	8.976
Sem±	0.597	2.881

Table 5. Appearance quality of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	8.67	8.00
T2	9.00	8.33
T3	9.00	8.33
T4	8.33	7.67
T5	9.00	8.33
T6	8.33	7.33
CD	N/A	N/A
Sem±	0.236	0.304

Appearance quality

The appearance quality of pomegranate peel powder blended with different spices during the storage is shown in Table 5. A 9-point hedonic scale was used to give out the points where 9 is like extremely and 1 is dislike extremely. At 0 DAS interval, maximum value of 9 was shown by T2 (90g pomegranate peel powder+10g turmeric powder), T3 (90g pomegranate peel powder+10g ginger powder) and T5 (90g pomegranate peel powder+ 10g onion powder). T1 (90g pomegranate peel powder+10g black pepper powder) recorded the next value of 8.67 and T4 (90g pomegranate peel powder+10g clove powder) and T6 (90g pomegranate peel powder) showed the values of 8.33. Thereafter at 40 DAS interval again the highest score was shown by T2 (90g pomegranate peel powder+10g turmeric powder), T3 (90g pomegranate peel powder+10g ginger powder) and T5 (90g pomegranate peel powder+ 10g onion powder). Whereas T6 (90g pomegranate peel powder) showed the least score of 7.33.

Fungal count

Table 6 shows the fungal count of pomegranate peel

Table 6. Total fungal count ($\times 10^2$ cfu/g) of pomegranate peel powder blended with different spices during the storage.

Treatments	0 DAS	40 DAS
T1	0.00	0.33
T2	0.00	0.00
T3	0.00	1.67
T4	0.00	0.00
T5	1.00	0.67
T6	0.00	0.33
CD	N/A	0.848
Sem±	0.236	0.272

powder blended with different spices during the storage. At 0 DAS interval it was observed that all the treatments developed no fungal colonies, except 1 fungal colony was seen for T5 (90g pomegranate peel powder+10g onion powder). Later on, at 40 DAS interval T3 (90g pomegranate peel powder+10g ginger powder) recorded with the highest fungal colonies of 1.67 followed by 0.67 in T5 (90g pomegranate peel powder+10g onion powder). T1 (90g pomegranate peel powder+10g black pepper powder) and T6 (90g pomegranate peel powder) recorded with 0.33 fungal colonies and no colonies were yet to be developed for T2 (90g pomegranate peel powder+10g turmeric powder) and T4 (90g pomegranate peel powder+10g clove powder).

In the experiment several parameters of fortified pomegranate peel powder with spices constituents during the storage period were analyzed. It was seen that the amount of total sugar obtained in the study were similar to the previous reports of Ullah *et al.* (2012) in their studies about pomegranate peel powder also the range of antioxidants percentage obtained for the peel powder prepared from pomegranate is quite similar to the earlier works of Ranjitha *et al.* (2018) in their study about the compositional aspects of fresh pomegranate peel powder. To access the appearance score, hedonic scale has been incorporated which is also been used in the previous works of Das *et al.* (2019). Thereafter it was seen that all the parameters except fungal count decreased during the storage analysis. The loss of the nutritional attribute from dehydrated pomegranate arils during the storage period has also been mentioned in the previous work of Ngangom *et al.* (2019).

CONCLUSION

Analysis of different parameter is Total sugar, Ascorbic acid, Antioxidant, Phenol, Appearance quality, Fungal count were done at 0 and 40 days after storage. From the study it was observed that all the parameters decreased except the fungal count during the study. For the Total sugar T2 (90g pomegranate peel powder+10g turmeric powder) on both the days (0 and 40) maintained the highest concentration. For ascorbic acid it was seemed that at 40 days interval T3 (90g pomegranate peel powder+10g

ginger powder) was best followed by T5 (90g pomegranate peel powder+10g onion powder). In case of antioxidant percentage at the end of storage T5 (90g pomegranate peel powder+10g onion powder) was recorded with the highest concentration. The phenolic analysis revealed that T2 (90g pomegranate peel powder+10g turmeric powder) was with the highest amount followed by T5 (90g pomegranate peel powder +10g onion powder). For appearance score highest value was received by T2 (90g pomegranate peel powder+10g turmeric powder). In case of fungal count up to 40 days, T2 (90g pomegranate peel powder+10g turmeric powder) was recorded with no colony development. Thus overall, we can conclude that T2 (90g pomegranate peel powder+10g turmeric powder) and T5 (90g pomegranate peel powder+10g onion powder) are better treatments that can be used to enhance the pomegranate peel powder for fortification and for utilization into different purposes.

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