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The effect of treatment pomegranate peel extract and calcium on the storage ability of broad beans (*Vicia faba* L.)

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Abstract

After harvesting the crop of broad beans grown in one of the orchards in Al-Hartha region, Basrah, Iraq for the agricultural season 2023-2024, the pods were separated to obtain the seeds by removing the pod, then the seeds were divided into three parts. A part of the seeds was treated by dipping in pomegranate peel extract at a concentration of 3 ml l^{-1} for 5 minutes,. The second part of seeds was dipped in calcium at a concentration of 2 ml l^{-1} for 5 minutes. The last part was dipped in distilled water only for 5 minutes. After the seeds dried, they were packed in perforated polyethylene bags (8 holes of 5 mm diameter) with an amount of 1 kg per bag and stored at a temperature of 4 °C for two weeks. The experiment was carried out as factorial experiment consisting of two factors, using Complete Rondomize Design (CRD) with 3 replicates. The results showed that 2 ml l^{-1} calcium treatment was the best in reducing the weight loss of seeds and recording the highest percentage of total soluble solids and protein, while the treatment of pomegranate peel extract was superior to the rest treatments in recorded the highest vitamin C. The results also showed that the two mentioned treatments did not record any significant decay after two weeks of storage compared to the control treatment. The weight loss of seeds, the percentage of decay, and the total soluble solids increased with increasing storage period, while the protein percentage and vitamin C concentration decrease with increasing storage period.

Keywords: bean seeds, pomegranate peel extract, calcium, weight loss, vitamin C

I. INTRODUCTION

Vicia faba L. is one of the important winter vegetable crops belonging to the fabaceae family, which is grown for its pods or fresh or dry seeds. It is considered the fourth most important leguminous crop in the world, as it occupies an important place among food security crops in a number of countries. This importance comes as a result of a high protein content of seeds, estimated at 8.4 gm per 100 gm of seeds (Winch, 2006). In addition to being a source of energy and containing a good percentage of crude fiber ranging between 5-8.5%, this has made the crop one of the most important low-cost food sources, especially in poor people, as an alternative to expensive animal proteins . The importance of

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beans is also due to their ability to improve soil properties through their contribution to fixing atmospheric nitrogen through the root nodule bacteria *Rhizobium leguminosarum* (Igwilo, 1982).

The modern trend in agriculture is to move away from the use of chemical fertilizers, chemical growth regulators, and pesticides due to their toxic effect on human and animal life. Therefore, researchers in agriculture have turned to finding safer materials, such as the use of plant and herbal extracts (Taain *et al*.,2017; Taain and Salman,2018). Polyphenols constitute the most part of components of pomegranate peels, which include flavonoids (flavonols, flavanols, and anthocyanins), condensed tannins, proanthecyanidins, and biodegradable tannins, ellagitannins, and gallotannins (Dahham *et al*., 2010). Calcium salts are used to increase the hardness of fruits and to treat many physiological disorders to fruits and resistance to damage, because calcium is involved in the construction of the middle lamina of the cell wall and plays an important role in activating many enzymes, and therefore treatment with calcium salts plays a major role, especially in the postharvest physiology of fruits (Taain and Hamza,2019) .The present study aims to improve the storage ability of beans after treating them before storage with pomegranate peel extract and calcium.

II. MATERIALS AND METHODS

After harvesting the crop of beans grown in one of the orchards in the Hartha region for the agricultural season 2023-2024, the pods were separated to obtain the seeds by removing the pod, then the seeds were divided into three parts. A part of the seeds was treated by dipping them in pomegranate peel extract at a concentration of 3 $ml.l^{-1}$ for 5 minutes,. The second part of seeds was dipped in calcium at a concentration of 2 $ml.l^{-1}$ for 5 minutes. The last part was dipped in distilled water only for 5 minutes. After the seeds dried, they were packed in perforated polyethylene bags with an amount of 1 kg per bag and stored at a temperature of 4 °C for two weeks. Tests were conducted on the seeds before storage and during the storage period as the decay and weight loss of seeds were calculated as percentages, Vitamin C (mg / 100 g) determined according to A.O.A.C. (1992). Total soluble solids determined by using hand refractometer and the results were corrected to 20 ºC.

The experiment was carried out as factorial experiment consisting of two factors, using Complete Randomize Design (CRD) with 3 replicates. The mean differences were compared using the least significant difference (L.S.D) test at the probability level of 0.05(Al-Rawi and Khalf Allah , 1980).

I. RESULTS AND DISCUSSIONS

1. Weight loss (%)

Table 1 showed the effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on the weight loss (%) of broad bean seeds stored at 4 °C. It is noted from the table 1 ,that the treatment with 2 ml l^{-1} calcium is superior to the rest treatments in reducing the weight loss of seeds stored at 4 °C that recorded 0.68%, followed by the treatment with

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pomegranate peel extract at the concentration of 3 ml l⁻¹ , which recorded 0.89%. The highest percentage of weight loss was in the control treatment (distilled water only), which gave 2.23% after two weeks of storage.

The water content of fruits is one of the most important factor affecting the fruit quality during storage because of the loss of water leads to reduce the turgor pressure of fruit tissues and wilting of fruits . Weight loss of fruits takes place as a result of the loss of stored food caused by vital processes especially respiration rate or as a result of the loss of water content due to an evaporation of water or both (Dessouki *et al*., 2001). Results are in constant with Taain *et al*. (2017) as reported that the loss of weight of tomato fruits hybrid Wegdan increased with the increment of storage period and the percentage of weight loss decreased in fruits treated with calcium chloride as compared to untreated fruits.

Table 1. Effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on weight loss (%) of bean seeds stored at 4 °C.

Treatments	Storage period (week)		Average treatments
	1	2	
Pomegranate peel extract (3 ml l⁻¹)	0.56	1.22	0.89
Calcium (2 ml/l⁻¹)	0.23	1.12	0.68
Control	1.33	3.12	2.23
Average storage period	0.71	1.82	
RLSD 0.05			
Treatment 0.22	Storage period 0.78	Treatment × Storage period 1.03	

2. Decay (%)

Table 2 showed the effect of treatment with pomegranate peel extract and calcium, storage period, and the interaction between them on decay (%) of broad bean seeds stored at 4 °C. It is noted from the table that the treatment with pomegranate peel extract 3 ml l^{-1} and the treatment with calcium 2 ml l^{-1} were superior to the control treatment due to the two treatments did not record any significant decay after two weeks of storage compared to the control treatment, which recorded 1.21% at the end of the storage period. It is also noted from the same table, the significance of the interaction between the treatments and the storage period in affecting the decay percentage, as it is noted that the highest percentage of decay was in fruits of the control treatment after two weeks of storage, which was 1.63%.

During handling and storage, fruits expose to damage that can take some forms depending on the reason. It may be the result of mechanical injuries resulting from the pressure of fruits each other inside the package or the damage caused by pathogens infections like bacteria, fungi and yeasts (Dementeva and Vegonski, 1988; Desouki *et al*., 1998). Results are in agreement with Fadala *et al*.

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(2023) as reported that decay percentage decreased when pepper fruits treated with calcium salts and stored for two weeks at 10°C.

Table (2): Effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on decay (%) of bean seeds stored at 4 °C.

Treatments	Storage period (week)		Average treatments
	1	2	
Pomegranate peel extract (3 ml l⁻¹)	0	0	0
Calcium (2 ml/l⁻¹)	0	0	0
Control	0.78	1.63	1.21
Average storage period	0.78	1.63	
RLSD 0.05			
Treatment 0.76	Storage period 0.22	Treatment × Storage period 0.88	

3. Total soluble solids

It is clear from table 3 that treatment of broad bean seeds with calcium at a concentration of 2 ml l⁻¹ achieved the highest percentage of total soluble solids, reaching 8.75%, with a significant difference from the rest treatments, followed by treatment with 3 ml l⁻¹ pomegranate peel extract , while the lowest percentage of total soluble solids was in the control treatment, which recorded 7.1%. It is noted from the table that total soluble solids increased as the storage period continued, reaching 8.3% after two weeks of storage.

Regarding the effect of the interaction between treatments and storage period, the highest percentage of total soluble solids was in the calcium treatment after two weeks of storage, while the lowest percentage of total soluble solids was in the control treatment after a week of storage.

The accumulation of total soluble solids with the increment of storage periods may be due to the decrease of water content of seeds with the increment of storage periods , led to increment the total soluble solids (Burton, 1982).

The application of post-harvest calcium preserved the dry matter content, as well as the role of calcium in reducing the breakdown of pectic soluble materials, which are a part of the total soluble solids and increases the firmness of cell walls because it is included in the synthesis of calcium pectate (Taain, 2005, Fadala *et al*.,2021).

Table 3. Effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on total soluble solids of bean seeds stored at 4 °C.

Treatments	Storage period (week)	Average

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	1	2	treatments
Pomegranate peel extract (3 ml l⁻¹)	7.8	8.2	8
Calcium (2 ml/l⁻¹)	8.5	9	8.75
Control	6.5	7.7	7.1
Average storage period	7.6	8.3	
RLSD 0.05			
Treatment 0.22	Storage period 0.72	Treatment × Storage period 1.07	

4. Protein (%)

The results of table 4 indicated that the treatments differed significantly in affecting the percentage of protein in the seeds. The 2 ml l⁻¹ calcium treatment excelled in recording the highest percentage of protein, amounting to 26.19%, followed by the treatment with pomegranate peel extract, while the lowest percentage of protein was in the control treatment, which was recorded. 21.78%. It is noted from the table that the percentage of protein decreased relatively as the storage period increased until reached 24.03% after two weeks of storage. As for the effect of the interaction between the treatments and the storage period, was significant, as it is noted that the highest percentage of protein was in the 2 ml l⁻¹ calcium treatment after a week of storage, which amounted to 26.35%, while the lowest percentage of protein was in the control treatment after two weeks of storage, which amounted to 21.42%.The results of present study are in the same line with Fadala(2022) as reported that there was no significant difference between the fruits of pepper sprayed with pomegranate peel extract and those treated with calcium, and both of them outperformed compared to control.

The reason for reducing the percentage of protein with the continuation of storage period maybe due to the biological processes that occur within the cells, which lead to the decomposition of protein (Taain *et al*.,2014) .

Table 4. Effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on protein (%) of bean seeds stored at 4 °C.

Treatments	Storage period (week)		Average treatments
	1	2	
Pomegranate peel extract (3 ml l⁻¹)	25.17	24.66	24.92
Calcium (2 ml/l⁻¹)	26.35	26.02	26.19
Control	22.14	21.42	21.78
Average storage period	24.55	24.03	
RLSD 0.05			
Treatment 1.25	Storage period 0.42	Treatment × Storage period 3.15	

5. vitamin C (mg $100g^{-1}$)

The results of table 5 showed that the treatment with 3 ml l⁻¹ pomegranate peel extract was superior in recording the highest concentration of vitamin C, which reached 16.55 mg $100g^{-1}$, followed by the treatment with 2 ml l⁻¹ calcium. The lowest concentration of vitamin C was in the control treatment,

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which recorded 11.61 mg $100g^{-1}$. It is noted from the same table that the concentration of vitamin C decreased with increasing storage period until reached 12.70 mg $100g^{-1}$ after two weeks of storage. As for the effect of the interaction between the treatments and the storage period, it was significant, as the highest concentration of vitamin C was in the treatment with 3 ml l^{-1} pomegranate peel extract after a week of storage, which amounted to 17.77 mg $100g^{-1}$, while the lowest concentration of vitamin C was in the control treatment after two weeks of storage, which amounted to 9.55 mg $100g^{-1}$.

The reason for decreasing a vitamin C with the continuation of storage period may be due to the increment of the activity of ascorbase and oxidase with the continuation of storage period and the exposure to light which caused the oxidation of vitamin C to dehydro ascorbic acid (Taain *et al*.,2014).

Table 5. Effect of treatment with pomegranate peel extract, calcium, storage period, and their interaction on Vitamin C (mg $100g^{-1}$) of bean seeds stored at 4 °C.

Treatments	Storage period (week)		Average treatments
	1	2	
Pomegranate peel extract (3 ml l^{-1})	17.77	15.32	16.55
Calcium (2 ml/l^{-1})	15.12	13.22	14.17
Control	13.66	9.55	11.61
Average storage period	15.52	12.70	
RLSD 0.05			
Treatment 1.98	Storage period 1.53	Treatment × Storage period 5.13	

II. REFERENCES

Al-Rawi K.M.; Khalf Allah M. (1980). Design and analysis of agricultural experiments, Mosul University, Iraq, p. 488.

A.O.A.C. (1992). Official method of analysis. Association of Official Analytical Chemists, WashingtonD.C.

Burton, W.G.(1982).Postharvest physiology of food crops. Longman, New York.310PP.

Dahham, S.S.; Ali, M.N.; Tabassum, H and Khan, M. (2010). Studies onantimicrobial and antifungal activity of pomegranatc (*Punicagranatum*). American – Eurasian Journal of Agriculture And Environmental Sciences 9(3) 273 – 281.

Dementeva M.E. and Vegonski M.E. (1988). Disease of Fruits, Vegetables and Potatoes during Storage, Moscow, pp. 231.

Dessouki I.M.; Algizawi A.M.; Abdel Azim M.M. ; Ahmed S. (2001). Technology of storage andexport of horticultural crops, College of Agriculture, Ain Shams University, Egypt.

Fadala, L. T.; Taain, D. A.; Hassan, F. A.(2021).The effect of adding humic acid,spraying some follar treatments on chemical components of fruits of chili pepper plants((*Capsicum annuum* L.)planted in

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/vvnbgm52*

unheated plastic houses conditions. Plant Cell Biotechnology and Molecular Biology 22(71&72):584-594.

Fadala (2022). The role of ground addition of humic acid and the application of some treatments before After harvest, there are indicators of growth, yield, and storage behavior of the fruits Two hybrids of cayenne pepper Capsicum annuum L. Grown in the greenhouse. Ph.D.thesis, college of agriculture,university of Basrah,Iraq.

Igwilo, N. (1982). Nodulation and Nitrogen accumulation in field beans (*Vicia faba* L). / Journal of Agricultural Science -Cambridge,. 98: 269-288.

Taain D. A. (2005). Effect of the package kind and storage temperature on qualitative characteristicsand storage behavior of date fruits cv. Barhi, Basrah, Journal of date palm Researches 4:54-70.

Taain, D. A. ; Jasim, A. M. ; Al-Hiji J. H.(2014).A study of storage behavior of okra fruits (*Abelmoschus esculuntus* L.Moenth cv.Khnesri) . International Journal of Farming and Allied Science7 :760-766.

Taain D. A., Abd A. K. M., Jaber N. A.-Z.(2017). Effect of pre and post-harvest treatment with plant extracts and calcium chloride on storage ability of tomato *Lycopersicon esculentum* Mill. fruits grown in plastic greenhouse. AAB Bioflux 9(3):161-172.

Taain, D.A. and Salman E. (2018). Role of spraying agazone and atonik in improving the storage ability of egg plant (*Solanum melongen* L.) hybrids Jawaher and Barcelona. International Symposium of Agricultureal and Mechanical Engineering. Bucharest . Romania. pp.211-219.

Taain, D.A.; Hama ,A.H.(2019). Effect of storage temperature and treatment with benzoic acid and calcium chloride on the storage ability of olive fruits (*Olea europeae* L.) cv. Khastawi. *Plant Archives*, Volume 19(2): 3082 - 3086.

Winch T.(2006). Growing Food. A Guide to Food Production. Springer: 36PP.