

Evaluation of New Storage Techniques to Increase Shelf Life of Roasted Pistachio

^{*1}Abdullah Masoumi, ¹Basir Ahmad Rahimi, ²T.H. Shankarappa, ¹Ahmad Shafiq Foshanji and ¹Nasir Ahmad Sahel

¹Food Technology Department, Herat University, Herat, Afghanistan

²Department of Postharvest Technology, College of Horticulture, UHS Campus, GKVK, Bengaluru- 560 065, India

*Corresponding Author: masoumi256@gmail.com

Abstract: *Roasted pistachio nut is prone to deterioration, an important concern during storage. We have evaluated latest storage techniques for roasted pistachio. Roasted pistachio was packed by vacuum, hermetic and normal package techniques and stored for 60 days in two conditions, low temperature and ambient temperature. The results showed gradual decrease in oil content, moisture content and sensory quality of roasted pistachio during storage. The changes in biochemical parameters of roasted pistachio was more prominent when stored under ambient condition, which was significantly different ($p < 0.05$) as compared to the low temperature stored roasted pistachio. The roasted pistachio kept in vacuum package and stored at low temperature condition was found to be superior in terms of sensory quality for biochemical changes.*

Keywords: oil content, roasted, sensory quality, storage roasted pistachio nut

1. INTRODUCTION

Pistachio nut is one of the most delicious and nutrient-dense nuts in the world with a healthy nutritional profile including fiber, healthy fats, phytosterols and anti-oxidant compounds (Bullo et al 2015). Pistachio plays nutritionally a significant role in meeting the body needs compared to other nuts such as walnuts, almonds and hazelnuts (Wilkinson 2005). Grapes, pistachios, and olives are among the crops viewed as likely to succeed in the export market (John 2014) which is expected to play a critical role in the economic rebuilding of Afghanistan via Agriculture. Pistachio forests are the major wild crops growing region in Afghanistan especially in western regions (Badghis and Herat) with an area of 450 thousand hectares (Mohammad 2015). Roasting is a process involve in the nut manufacturing industry to improve the flavour, colour, texture and overall acceptability of the product. Roasted pistachio nuts are a major product of Herat market. Deterioration of pistachio nut is a major concern of storage which accounts the most important technical problem of the food industries at Herat market, Afghanistan. Mould and insects are other damages which makes the pistachio unacceptable for human consumption. Earlier investigated works suggest that roasted pistachios packed under normal air conditions showed higher peroxide index than vacuum packed ones (Sedaghat et al 2011). Vacuum package could increase the shelf life of pistachio powder (Rafsanjani et al 2018). Where, packaging pistachio nuts under vacuum condition offered effective resistance against oxygen and humidity as well as prevented aflatoxin producer fungi growth even in a highly humid storage condition (Javanshah et al 2007). While, packaging of pistachio nut in metalized five-layer films filled with N₂/CO₂ and under vacuumed conditions kept the quality of pistachio better and lengthened shelf life (Raei et al 2009). Green Pistachio is one of oldest factory in Herat market with more than 60 years of experience, located at Bazar Malik, 7th Region, Herat, Afghanistan. This factory basically works on processing and marketing of dry nuts (pistachio, raisin, walnut, almond, and other dry nuts). Herat pistachio processors traditionally store the pistachio nuts at ambient condition with normal plastic packages which limit the storage life of the products to less than one month. The possibility of increasing the storage life of pistachio by applying new techniques to overcome common method of processing which may limit pistachio nut deterioration by reducing oxygen concentration and temperature in the storage atmosphere of stored product was valued.

Methods and Material

The experimental work was carried out at the department of food technology, Herat University, Afghanistan, during 01 April to 30 June 2019. The raw materials used in this research were collected from Green Pistachio Factory. The roasted pistachio were packed in 3 types of packages (vacuum package, Hermetic storage and normal package) and kept in two storage conditions (low temperature 4-7 °C and ambient temperature). Later, biochemical and organoleptic qualities were evaluated at different intervals during storage.

Pistachio oil extraction was performed according to the methods explained by Sahoo et al 2016. Pistachio oil contents (%) were extracted using Soxhlet apparatus having hexane as solvent, heated at 60-80°C for 8 hours. The solvent was evaporated from extracted oil under vacuum at 30°C. Moisture content of pistachio kernel was measured using electronic moisture analyzer (Model: Wensar PGB-1MB) and the direct reading was noted down from the instrument screen and expressed in per cent. Organoleptic evaluation of roasted pistachio was conducted on the basis of appearance, flavor, taste, after taste, texture and overall acceptability by a panel of ten judges using a nine point Hedonic scale as laid out by Amerine et al (1965).

Results and Discussion

Significant differences were recorded in oil content of roasted pistachio during 60 days of storage period (Table 1). The roasted pistachio showed a decreasing trend in oil content during storage period where maximum decrease in oil content was in pistachio stored with normal package and kept at ambient condition. Irrespective of the treatments, the pistachio stored at low temperatures recorded a significantly lower decrease in oil content as compared to ambient storage condition. Decrease in oil content may be due to development of rancidity caused by deterioration of oil as a result of oxidation process between unsaturated fatty acids and oxygen. The rate of oxidation would have increased with the increase in concentration of oil and duration of exposure during storage period. The oxidation of oil requires the presence of atmospheric oxygen, also, longer the storage time higher is the oxygen availability and vice-versa as reported earlier by Sisman (2005) and Arena et al (2013) in storage of pistachio nut.

Table 1: Oil content of roasted pistachio during storage period

Treatment	Oil content (%)		
	Days after storage		
	20	40	60
T ₁ : VP + LT	5.08 ^a	4.89 ^a	4.85 ^a
T ₂ : VP + AT	4.76 ^b	4.46 ^{bc}	4.34 ^{bc}
T ₃ : HS + LT	4.8 ^b	4.54 ^b	4.7 ^a
T ₄ : HS+ AT	4.36 ^c	4.35 ^c	4.2 ^b
T ₅ : NP + LT	4.78 ^b	4.52 ^b	4.44 ^b
T ₆ : NP + AT	3.88 ^d	3.92 ^d	3.9 ^d

Note: Initial oil content: 5.14; VP: vacuum package; HS: hermetic storage; NP: normal package; LT: low temperature; AT: ambient temperature.

Moisture content (%) of the roasted pistachio during 60 days of storage differed significantly (Table 2). The decreasing trend of moisture was in all the treatments during storage period, a maximum decrease was in roasted pistachio kept in normal pack and stored under ambient condition. Irrespective of the treatments, the pistachio stored at higher temperature recorded a significantly higher decrease in moisture content as compared to lower temperature storage condition. This might be due to changes in relative humidity of storage area and effectiveness of package which can control moisture content during storage period as seen in storage of pistachio nut cream during eight months of storage at 4-20°C Gaml and Hayoglu (2012) and Arena et al (2013).

Table 2: Moisture content of roasted pistachio during storage period

Treatment	Moisture content (%)		
	Days after storage		
	20	40	60
T ₁ : VP + LT	2.45 ^a	2.38 ^a	2.36 ^a
T ₂ : VP + AT	2.27 ^a	2.27 ^{ab}	2.24 ^{ab}
T ₃ : HS + LT	2.41 ^a	2.42 ^a	2.32 ^a
T ₄ : HS+ AT	2.38 ^a	2.36 ^{ab}	2.22 ^{ab}
T ₅ : NP + LT	2.33 ^a	2.22 ^c	2.36 ^a
T ₆ : NP + AT	2.33 ^a	2.21 ^c	2.09 ^b

Note: Initial Moisture content: 2.40; VP: vacuum package; HS: hermetic storage; NP: normal package; LT: low temperature; AT: ambient temperature.

A continuous decreasing trend was observed for the sensory score of roasted pistachios during 60 days of storage and the data presented in (Table 3). Majority of the panelists gave preference score such as “Extremely good” during initial day and “Very good” at last day of storage. The maximum scores were received by roasted pistachio treatment, vacuum package and low temperature storage after 60 days for parameters like appearance and overall acceptability. It implies that under low temperature condition storage having vacuum pack and hermetic pack and possible to maintain the sensory quality of roasted pistachio, where, low temperature, vacuum and hermetic package help to protect and maintain the quality of roasted pistachio.

Table 3: Sensory quality of roasted pistachio at 60th day of storage period

Treatments	Quality Attributes (10 point hedonic scale)					
	Appearance	Flavor	Taste	After test	Texture	Overall acceptability
T ₁ : VP + LT	7.41	7.27	7.23	7.05	7.32	7.64
T ₂ - VP + AT	7.18	7.18	6.91	6.77	7.45	7.09
T ₃ - HS + LT	7.59	7.36	7.41	7.41	7.23	7.55
T ₄ - HS+ AT	7.27	7.14	7.00	7.27	7.41	7.36
T ₅ - NP + LT	7.82	7.14	7.14	7.23	7.36	7.41
T ₆ - NP + AT	7.27	6.00	6.09	5.73	6.64	5.82
Initial score	8.17	8.33	8.25	8.25	8.38	8.46

Note: VP: vacuum package; HS: hermetic storage; NP: normal package; LT: low temperature; AT: ambient temperature.

Conclusion

Storage study of roasted pistachio were tested in using three types of packages, namely, vacuum package, Hermetic storage and normal package under two different storage conditions for 60 days. The oil content, moisture content and sensory scores of roasted pistachio decreased during 60 days of storage period. The changes in the biochemical and sensory scores were high for roasted pistachio kept under ambient storage condition as compared to the low temperature storage. The vacuum package and low temperature storage to be superior for storing roasted pistachio up to 60 days, in terms of biochemical and sensory quality.

References

- Amerine, M. A., Pangborn, R. M. and Rosseler, E. B. (1965). Principles of sensory evaluation of food. *Academic Press*, London.
- Arena, E., Ballisteri, G. and Fallico, B., (2013). Effect of storage temperatures on the quality parameters of pistachio nuts. *Czech Journal of Food Sciences*. 31(5): 467-473.
- Bullo, M., Juanola, M., Hernandez-Alonso, P. and Salas-Salvado, J., (2015). Nutrition attributes and health effects of pistachio nuts. *British Journal of Nutrition*. 113: 79-93.
- Gaml, O. F. and Hayoglu, I., (2012). Effects of Nut Proportion and Storage Temperature on Some Chemical Parameters of Pistachio Nut Cream. *Journal of Food Science and Engineering*. 2:15-23.
- Javanshah, A., Abdolahi, M., Shakerardekani, A., Hokmabadi, H., Mohammadi, A. H., Arjmand, M., Alavi, H., Masoomi, H. and Rafiei, A. E., (2007). Technical and economic study and comparison of two types of plastic packaging in two packing condition (Normal and Vacuum) and two storing condition (Normal and High Moisture) on Pistachio packaging. *Iran Pistachio Research Institute, Rafsanjan*.
- John, W. G., (2014). Forestry and Forestry Education in Afghanistan. *Journal of Forestry Washington*. 104: 426-430.
- Mohammad, Y., (2015). Pistachio, an export nut in Afghanistan. *Afghan paper*. News code: 106675.
- Raei, M., Mortazavi, A. and Pourazarang, H., (2009). Effects of packaging materials, modified atmospheric conditions, and storage temperature on physicochemical properties of roasted Pistachio nut. *Food Analytical Method*. 3(2):129-132.
- Rafsanjani, N. D., Daneshi, M. and Shakerardekani, A., (2018). Effect of freezing and vacuum packaging on quality properties of pistachio powder during storage, *journal of Nuts*. 9(2): 169-179.
- Sahoo, P. K., Nayak, S., Behera, L. K., Rout, S. and Biswal, D., (2016). Influence of storage condition and duration on oil content of Physicnut seeds, *International Refereed Peer Reviewed Research Journal*. 4:173-176.
- Sedaghat, N. and Tavakoli, J., (2011). Study of quality properties of Motika variety under different storage and packaging conditions. *Iranian Journal of Food Science and Technology*. 17-26.
- Sisman, C. and Delibas, L., (2005). Storing sunflower seed and quality losses during storage. *Journal of Central European Agriculture*. 4:239-250.
- Wilkinson, J., (2005). Nut Grower's Guide: The Complete Handbook for Producers and Hobbyists. Landlinks Press. 175-188.