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Study on the Post-Harvest Physical and Chemical Characteristics of Apricot (Prunus Armeniaca L.) in Peshawar

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Abstract
Physical and chemical properties of four apricot varieties viz., Travett, Palumella, Charmaghz and Badami, fruits were presented in this study. Information about these properties is very important for understanding the behavior of the product during the post harvest operations such as harvesting, transporting, sorting, packing and storage processes. The mean value of fruit length, width, thickness, weight, volume, pulp weight, kernel weight were established between 40.36-31.19mm, 36.17-26.76mm, 32,20-26.16mm, 30.63-23.83g, 29.53-22.10cm³, 29.91-22.20g, 2.63-1.63g, respectively. The chemical properties which include TSS was found in range of 11.27-9.43, total sugar 11.21-8.75%, reducing sugar 2.43-1.65%, non-reducing sugar 7.35-6.32 and titratable acidity 1.60-1.12%. Therefore, based on physical (quality) properties varieties Palumella and Charmaghz were found superior, whereas in chemical properties varieties Badami and Travett were the best among the tested varieties.
Keywords: Apricot (*Prunus armeniaca* L), Apricot, physical and chemical properties, Pakistan.

Introduction

Apricot (*Prunus armeniaca),* a stone fruit of the family Rosaceae, is considered by many to be one of the most delicious temperate tree fruits. Apricot tree have been appreciated and grown for thousand of years on the slopes of mountains in Asia and at least two thousand years in Europe (Fabrizio *et al.*, 2001). In Pakistan, it is cultivated from 300 – 2000 m above sea level and varieties grown on higher elevation are superior in quality (Malik, 2001).

Today the greatest world apricot production is supplied by Mediterranean countries i.e., Turkey, Spain, Italy, France and Greece. Apricot varieties cultivated in this area belong to *P. armeniaca* L. species and to the European eco-geographical group. This group is the most recent and the least variable. Commercial cultivars show good local adaptability and represent an interesting genic pool for breeding programs (Fabrizio *et al*., 2001). Apricot plays an important role in human nutrition, and can be used as a fresh, dried or processed fruit such as frozen apricot, jam, jelly, marmalade, pulp, juice, nectar, extrusion products etc. Moreover, apricot kernels are used in production of oils, cosmetics, active carbon and aroma perfume (Janatizadeh *et al.,* 2008). Apricot is rich in mineral such as potassium, and vitamins such as β-carotene which is the pioneer substance of vitamin A (Haciseferogullari *et al*., 2005). Apricot tree can grow over the five continent of the world and production level exceeds 2 million tons annually. Australia, France, Hungary, Italy, Morocco, Spain, Tunisia, Turkey can be regarded as important apricot producing countries. While some of the countries such as Hungary, Morocco, Iran and Tunisia are important fresh apricot exporters, the others, such as Australia and Turkey are major and famous dried apricot producer and exporters. Dried apricot which are in extensive demand in several parts of the world i.e., USA, UK, Germany, Australia, etc, occupy an important place in the world trade. In 2005, turkey and Iran (having cultivated area with 20000 hectares and with average annual production of 275 580 tons were the largest producer of apricot in the world (USDA, 2004).

The modern apricot industry needs commercial cultivars characterized by high fruit quality attributes because too frequently consumers are not satisfied with qualitative standard of mostly horticultural products. Due to this situation, most of the principal apricot breeding programs are focused on quality criteria. Firmness and visual appeals are the most important traits demanded by fresh market although there is growing concern for fruit flavor. Today, most breeding programs are focused on improvement of apricot flavor through determination of the role played by principal acids and sugar in flavor expression (Fabrizio et al., 2001) that also analyzed and quantified major sugar and acid components in apricot fruits over a period of several production years. Agriculture crops and food products have several unique characteristics which set them apart from engineering materials. These properties determine the quality of the fruit and identification of correlations between changes in these properties makes quality control easier. Proper design of machine and processes to harvest, handle and store agriculture materials require an understanding of their physical properties (Janatizadeh *et at*., 2008). Information regarding dimensions attributes is used in describing fruit shape which often necessary in horticulture research for a range of different purposes, including cultivar descriptions for plant variety rights or cultivar registers (Mirzaee *et al*., 2009).

Information are lacking on the physical and chemical properties of apricot cultivars growing in Pakistan, which are very important for understanding the behavior of the products during the post harvest

operation such as harvesting, transporting, sorting, grading, packaging, and storing processes, and also in processing operations such as cooling, drying etc. There are two main objectives of this study. The first is to determine the physical properties which include fruit length, width, thickness, fruit weight, fruit volume, seed weight and pulp weight which are necessary for post harvest operation. The second is to determine chemical properties such as total soluble salts (TSS), titratable acidity, total sugar, reducing sugar and non reducing sugar which are important for processing operation.

Materials and Methods:

In this study some post-harvest physical and chemical characteristics of four apricot cultivars (Travett, Palumella, Charmaghz and Badami) were determined at Agricultural Research Institute Tarnab, Peshawar- the capital city of North West Frontier province of Pakistan during 2011-12. Three sample, each sample consisted of 20 fruits were randomly collected from each cultivar at edible maturity. They were kept at shade for 5 hours and then, washed with tape water to remove field heat. Fruit weight, seed weight and pulp weight were determined with an electronic balance with 0.1g sensitivity. To determined average size of the fruit, three linear dimensions namely as length, width and thickness was measured (Janatizadeh., 2008). Volume (V) was determined using the water displacement method (Mohsenin, 1986). Some chemical characteristics like total soluble solids (TSS), total sugar %, reducing sugar %, non reducing sugar% and titratable acidity % were determined. Total soluble solids were determined by taking representative juice of each sample on hand refractometer according AOAC (1990).

Results and Discussion:

Physical properties:

Some post harvest physical and chemical properties of four apricot cultivars namely Travett, Palumella, Charmaghz and Badami are depicted in Table 1. These physical properties were found at specific moisture content of 81.61, 86.17, 84.24 and 80.12% for Travett, Palumella, Charmaghz and Badami, respectively. Knowing these moisture content values was helpful in analyzing the convective dehydration of apricot as suggested by Ochoa et al. (2007) who reported that during convective dehydration of whole apricot, both volume and surface area changes are independent of operating conditions in the tested range, and are related only to the moisture content of partially dehydrated fruit. Considering water, which is an important component in most fruits and determines their perishability, knowledge of fruit moisture content and water activity is very useful to forecast the stability conditions in apricot fruits in order to select formulations and storage conditions in new products and to improve drying processes and equipments (Jannatizadeh, 2008). As revealed from Table 1, all properties considered in this study were found statistically significant at 5% probability level. The greatest dimensional characteristics were found for Palumella cultivar 40.36, 36.17 and 32.20mm related to length, width and thickness, respectively. Whereas these values were recorded 35.74, 33.22 and 31.29mm 34.78, 30.32 and 29.30mm for Charmaghz and Badami respectively. The lowest values of length (31.19mm), width (26.76mm) and thickness (25.16mm) were found for Travett cultivar. To design a mechanism for mechanical harvesting (Hacthaliloglu L.), Erdogan *et al*. (2003) reported length, width and thickness of the fruit as 38.94, 40.92 and 35.21mm, respectively. The axial dimensions are important in determining the aperture size of machines, particularly in separation of materials, and these dimensions may be useful in estimating the size of machine components. For example they may be useful in estimating the number of fruits to be engaged at a time, the spacing of slicing discs, and number slices expected from an average fruit (Mirzaee *et al.* 2009).

Cultivar Palumella (30.63g) and Charmaghz (28.40g) were statistically similar at 5% probability level in relation to fruit weight while different from Badami and Travett cultivars with fruit weight 24.67g and 23.83g, respectively. The greatest pulp weight 27.91 g and kernel weight 2.63 g were found for Palumella followed by Charmaghz with pulp weight 26.37 g and kernel weight 2.03 g. Whereas these values were 22.87 and 22.20 g, 1.80 and 1.63 g as pulp and kernel weight for cultivars Badami and Travett, respectively . The corresponding values of fruit weight was fond to be 28.8 g for apricot (Hacthaliloglu L.), reported by Erdogan *et al*., 2003), and 21.33 g for Alyanak cultivar found by Betul Akin *et al,* (2008). This property may be useful in the separation and transportation of the fruit by hydrodynamic means in water canals (Jannatizadeh *et al*. 2008).

Table1. **Showing Physical Properties Of Four Apricot Varieties Planted ARI Tarnab, Peshawar.**

Varieties	L(mm)	W(mm)	T(mm)	Fw(g)	Sw(g)	Pw(g)	V(cm³)
Travett	31.19 b	26.76 d	25.16 c	23.83 b	1.63 c	22.20 b	22.10 c
Palumella	40.36 a	36.17a	32.20 a	30.63 a	2.63 a	27.91 a	29.12 a
Charmaghz	35.74 ab	33.22 b	31.29 a	28.40 a	2.03 b	26.37 a	29.53 a
Badami	34.78 ab	30.32 c	27.30 b	24.67 b	1.80 c	22.87 b	23.40 b
LSD	5.592	1.66	1.105	2.392	0.236	2.421	0.744

L: fruit length; W: fruit width; T: fruit thickness; FW: fruit weight; SW: seed weight; PW: pulp weight; V: volume.

The volume of Charmaghz (29.53 cm³) and Palumella cultivar (29.12 cm³) were statistically at par with one another. The volume values for Badami and Travett were 23.40 and 22.10 cm³, respectively. These results are in agreement with the finding of Mirzaee *et al.* (2009) who reported fruit volume 45.60, 26.20 and 23.30 cm³ for cultivars Rajabali, Ghavami and Nasiry, respectively. Considering the results, it is clear that a large number of Trarvett fruit can be packed in the predetermined volume compared with other cultivars.

Chemical properties:

Maximum total soluble solids (TSS) contents (11.27) were found for cultivar Travett followed by Badami with 10.23 TSS contents (Table 2). The lowest TSS contents of 9.43 were recorded for cultivar Palumella while TSS contents (10.0) of Charmaghz did not show significant difference with Palumell and Badami. These results are in line with those of (Ishaq et al,. 2009) who reported 11.8% TSS contents in fresh apricot fruits and with those of Agar and Polate (1995) who had observed that TSS contents in different varieties of apricot were increased from 10.6-14 during storage. As for the percent total sugar, Palumella, Charmaghz and Badami varieties form statistically homogenous group with total sugar 8.75, 9.33 and 9.41% respectively, and don't revealed significant difference at 5% probability level. The total sugar (11.21%) of Travett is significantly greater from the three varieties of aforementioned group. In apricot main sugar is sucrose and fruit contain starch, pectic materials, disaccharide and monosaccharide such as sugar like sucrose, fructose, and glucose. The amount of all these sugars drastically increased during ripening of fruit (Ishaq et al 2009). The highest reducing sugar contents (2.43%) was found in cultivar Palumella whereas Charmaghz with reducing sugar (1.76%) and Travett (1.65%) are statistically at par with each other. Badami with reducing sugar (2.06%) is not statistically different from the rest of three studied cultivars. Regarding non-reducing sugar, there are two statistically similar groups. The first one is of cultivars Badami and Charmaghz with higher non-reducing sugar contents of (7.35%) and (7.19%) respectively, whereas the second group includes cultivars Travett (6.33%) and Palumella (6.32%) non-reducing sugar contents.

Table 2. Showing Chemical properties of four apricot varieties planted ARI Tarnab, Peshawar.

Varieties	TSS	% total sugar	% RS	%NRS	% acidity
Travett	11.27 a	11.21 a	1.65 b	6.33 b	1.25 b
Palumella	9.43 c	8.75 b	2.43 a	6.32 b	1.60a
Charmaghz	10.0 bc	9.33 b	2.06 ab	7.19 a	1.30 b
Badami	10.23 b	9.41 b	1.76 b	7.35 a	1.12 b
LSD	0.57	0.75	0.48	0.58	0.24

RS: reducing sugar; NRS: non-reducing sugar.

The titratable acidity was statistically higher (1.6%) in cultivar Palumella. The other three cultivars Travett, Charmaghz and Badami with titratable acidity 1.25, 1.3 and 1.12% were found statistically similar at 5% probability level. Titratable acidity is directly related to the concentration of organic acids present in the fruits.

Organic acids exist as free acids, anions (malate) or combined as salt (potassium bitartarte) and esters such as isopentyle acetate (Ishaq *et al*., 2009). The results related to titratable acidity of apricot fruit as shown in Table 2, are in line with those of Agar and Polate (1995) who had observed that titratable acidity was decreased from 1.4-0.8% in different varieties of apricot during storage.

Conclusions:

From this study it can be concluded that: The highest and the lowest values of length, width, thickness, volume, fruit weight, pulp weight and kernel weight were found for Palumella and Travett, respectively. Travett has the highest TSS contents, total sugar and the lowest percent acidity was found in Badami followed by Travett. Therefore, based on physical (quality) properties varieties Palumella and Charmaghz were found superior, whereas in chemical properties varieties Badami and Travett were the best among the tested varieties.

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