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Evaluation of fruit physicochemical properties in some peach cultivars

Jafar Hajilou* and Shabnam Fakhimrezaei

Department of Horticultural Sciences, Faculty of Agriculture, University of Tabriz, Iran
Corresponding author email : J_Hajilou@tabrizu.ac.ir

Detailed information about fruit chemical properties is very important for understanding the product behavior during the delivery chain. The present study was carried for determining some chemical and physical properties of fruit such as titratable acidity, pH, total soluble solid (°Brix), Vitamin C, dry matter (%), fruit water content (%), ash (%) and fruit mass in 8 peach cultivars: 'Zoodras', 'Khouni-haste-joda', 'Kosari', 'Anjiri-ye-tabestane', 'Anjiri-ye-maleki', 'Anjiri-ye-khouni', 'Haj-kazemi', 'Haste-joda'. Results showed significant differences between studied cultivars, in all of properties except ash (%). The highest Brix and dry matter and the lowest fruit water content between studied cultivars were corresponded to 'Anjiri-ye-khouni'. In general, 'Zoodras' had the lowest Total soluble solids (TSS) and the highest fruit water content. Total soluble solid content of these eight cultivars are ranged from 11.50 to 17.33 °Brix. The highest vitamin C and titratable acidity and the lowest pH were corresponded to 'Khouni-haste-joda'. 'Anjiri-ye maleki' had the highest TSS/Ta ratio and the lowest acidity and vitamin C content.

Key words: Peach, cultivar, Total soluble solids, Titratable acidity, Vitamin C, Dry matter, Water content.

The consumption of horticultural crops particularly stone fruits plays an important role in the maintenance of health and prevention of chronic degenerative diseases such as tumours, cardiovascular diseases, cancer and atherosclerosis (Doll, 1990; Ames et al., 1993; Dragsted et al., 1993; Anderson et al., 2000). Peaches were developed in Asian countries and grown in temperate and sub-tropical areas. Universal production of peach is in excess of 18,000,853 tones and the top six production countries are: China, Italy, United States, Spain, Greece and Iran. The production of peach in 2008 was 574958 million tons (FAO, 2008). East azarbaijan province is an important state of peach production in Iran and 21561,4 tons peach fruit were harvested from this region, where the present study was undertaken (MAJ, 2008). The health promoting property of peaches is due to the range of nutrition component, phenolic compounds, carotenoids and antioxidants they contain. Previous researches about peach nutrition revealed that peach fruit contains a rich source of carbohydrates, organic acids, pigments, phenolics, vitamins, volatiles, antioxidants and trace amounts of proteins and lipids. According to some researches, peach is an excellent source for potassium, iron, fiber, vitamin A, vitamin C and other vitamins and also contains high concentrations of phytochemicals such as Carotenoids, flavonols and anthocyanins (Hancock and Scorza, 2008; Scorza and Okie, 1991; Crisosto and Costa, 2008). Ascorbic acid (vitamin C), carotenoids and phenolic compounds represent the major sources of antioxidants in peaches (Chang et al, 2000;

Gil et al, 2002; Tomas-Barberan et al, 2001; Byrne, 2002).

Appearance properties (skin color), texture, flesh firmness, acid/sugar ratio are the key factors for fresh and good quality fruits. But, only parameters being considered in quality definition are fruit size and skin color. The mentioned other characters which are perceived by the consumer as fruit quality, are completely disregarded by the grower and other individuals along the chain. In other words, the grower does not consider that fruit size is only the first characters perceived by the consumer and they orient him just in his very first choice (Crisosto and Costa, 2008). It is imperative for the growers and other individuals in the delivery chain to direct their attention to fruit quality from the consumer's perspective in order to regain the confidence of the consumer, and as new plantings are based on new cultivars with different organoleptic characteristics (low- and high acid, high SSC, highly aromatic, etc.) and since new markets and consumer groups with different ethnic backgrounds are being reached (Liverani et al., 2002; Crisosto, 2003a), it is important to classification cultivars according to characters which are determining consumer acceptance and segregate cultivars into different organoleptic categories (Crisosto, 2002, 2003a, b). Thus, as a long-term solution, breeding programs include quality characteristics in their screening process, and the creation of peach categories with their own quality indices according to an organoleptic description may help marketing and promotion.

Regardless, some information about peach fruit nutrition said above, processing and production units and consumers need a lot of information about fruit chemical properties. This detailed information is very important for understanding the product behavior during the harvesting, transporting, packaging and storing of fruit crops. The use of this information about quality indexes for breeding programs will allow the development of peach cultivars with good quality attributes. Thus, the goal of this study was to evaluate the fruit quality attributes of some Iranian peach cultivars.

1. Materials and methods

Plant materials

Eight peach (*Prunus persica* L.) cultivars 'Zoodras', 'Khouni-haste-joda', 'Kosari', 'Anjiri-ye-tabestane', 'Anjiri-ye maleki', 'Anjiri-ye khouni' , 'Haj-kazemi', 'Haste-joda' grown in collection orchard of Tabriz University, were carefully hand-picked at a commercial maturity stage. They were kept in cooled bags during transportation to the laboratory and some chemical and physical properties of fruit were examined. All of the analyses were carried out at room temperature of 25 °C during the laboratory tests.

Fruit quality attributes

Fruits were stoned and homogenized, and the homogenate samples were analyzed for total soluble solid content using a digital refractometer (Atago Model PR-1, Tokyo). The method for analysis of titratable acidity was based on titration of the acids present in the fruit juice with sodium hydroxide (0.1 N). Values of titratable acidity were expressed as % malic acid. The pH value was measured using a digital pH-meter (WTW Inolab pH-L1, Germany). Vitamin C content (mg.500g-1 fw) was determined using 2, 6-Dichlorophenolindophenol by visual titrimetric method (AOAC, 2005). Results were expressed as mg ascorbic acid 500g-1 fresh weight (fw).

To determine water and dry matter content (%) thin slices of the fruit were heated in an oven (65^{o}C, 48 h) until a constant weight was obtained and the weight loss was used to calculate the water and dry matter content in fruit. Ash content was measured according to Ough and Amerine (1998) method. The ash content was determined by igniting a sample of the air-dried plant material in a muffle furnace at 550°^{c} to a constant weight. It is expressed

as a percentage of the oven-dry weight of the sample before heating (Ough and Amerine, 1998).

Statistical analysis

All data in the present study were analyzed according to a completely randomized experimental design. The results calculated statistically by analysis of variance (ANOVA). Mean values were compared by Duncan's multiple range tests using the statistical software SPSS 16.

Results and Discussion

The chemical properties of cultivars assessed are given in Table1. As seen in this table, the lowest titratable acidity was corresponded to 'Anjiri- ye- maleki', and the highest value of this parameter was belong to 'Khouni-haste-joda'.

Crisosto and Crisosto (2005) reported that degree of consumer acceptance was significantly related with total soluble solids, although maximum consumer acceptance was attained at different total soluble solid levels depending on the cultivar. In this regard, the highest total soluble solids was correlated to 'Anjiri-ye -khouni' (17.33 ^{o}Brix) which had significant difference with other cultivars. The lowest content of total soluble solids was recorded in 'Zoodras' (11.50 ^{o}Brix) (Table1). 'Zoodras' (which is an early season cultivar) had lower TSS content in contrast with 'Haj-kazemi' (a Middle season cultivar). This result is in agreement with researches of other authors (Souza et al., 1998, 2000; Byrne, 2002; Crisosto et al. 2008) which indicated that total soluble solid content of early season cultivars is lower than late season cultivars.

According to Voca et al (2008) the relationship between total soluble solids and total acidity is very important parameter in determining fruit quality, because it provides information on the sugar/acids balance in the fruits. Natural higher total soluble solids and lower titratable acidity of 'Anjiri-ye-maleki' cultivar in comparison with the other cultivars caused the highest TSS/TA ratio of the mentioned cultivar. The lowest TSS/TA ratio was recorded in 'Kosari' cultivar, which had no significant differences with 'Zoodras' and 'Khouni-haste-joda' (Table1).

Regarding to vitamin C, significant differences were recorded among studied cultivars. 'Khouni-haste-joda' (61.66 mg.100g^{-1} fw) had the highest content of vitamin C, which was up to 1.5–fold higher than 'Anjiri-ye-maleki' (Table1).

Our results are in agreement with reports of other researchers who claimed that the Vitamin C content in peaches depends on the genotype. As, Vitamin C content in a survey of ten cultivars of California peach ranged from 6 to 9 mg.100g-1 fw in white fleshed and from 4 to 13 mg.100g-1 fw in yellow fleshed peach (Gil et al., 2002). Accordingly, similar concentrations of ascorbic acid (5–6 mg.100g-1 fw) have been found in European peach cultivars (Carbonaro et al., 2002; Proteggente et al., 2002).

The native peach cultivars of the present study showed higher TSS and vitamin C content compared to other peach cultivars which had total soluble solids ranged from 8.5 to 12.5 ^{o}Brix and vitamin C content ranged from 6 to 16 mg.100g^{-1} fw (Wills et al, 1983).

Results of current study are in agreement with researches which indicate that total soluble solids and titratable acidity in peaches are determined by several factors such as cultivar (Byrne, 2003; Crisosto *et al.,* 1995, 1997; Crisosto, 2003b; Frecon *et al.,* 2002; Liverani *et al.,* 2002; Kader, 1992).

As seen in Table 2 'Anjiri-ye -khouni' contained the highest dry matter content (20.56 %) and the lowest water content (79.44%). The lowest value of dry matter content and the highest content of water was corresponded to 'Zoodras'. The pH of studied cultivars ranged from 3.47 to 4.89.

The highest and lowest values of pH were corresponded to 'Anjiri-ye maleki' and 'Khouni-haste-joda', respectively. About the Ash content, no significant differences was recorded (Table 2).

Table1. Fruit chemical attributes in some Iranian cultivars measured

Cultivars	Titratable Acidity (%)	pH	TSS/ TA ratio	TSS (^{o}Brix)	Vitamin C (mg.500g^{-1} FW)
'Zoodras'	0.89^{bc}	3.72^{cd}	13.01^{c}	11.50^{f}	47.77^{bc}
'Khouni-haste-joda'	1.05^{a}	3.47^{e}	12.74^{c}	13.38^{cd}	61.66^{a}
'Kosari'	0.97^{ab}	3.52^{e}	12.28^{c}	12.00^{ef}	60.83^{a}
'Anjiri-ye-tabestane'	0.29^{e}	4.61^{b}	44.32^{b}	12.88^{de}	56.51^{ab}
'Anjiri-ye-maleki'	0.25^{e}	4.89^{a}	63.30^{a}	15.50^{b}	40.74^{c}
'Anjiri-ye-khouni'	0.41^{e}	4.72^{b}	45.49^{b}	17.33^{a}	42.13^{c}
'Haj-kazemi'	0.65^{d}	3.73^{cd}	18.50^{c}	12.00^{ef}	51.62^{abc}
'Haste-joda'	0.81^{c}	3.61^{de}	15.48^{c}	12.50^{de}	61.40^{a}

Each value represent the mean of 3 replicates, means followed by the same letters are not significant different for p=0.05 in one-way ANOVA test.

Table2. Fruit physical attributes in some Iranian cultivars measured

Cultivars	Mass (gr)	Dry matter (%)	Water content (%)	Ash (%)
'Zoodras'	198.40^{ab}	14.06^{b}	85.94^{a}	0.50^{ns}
'Khouni-haste-joda'	239.40^{a}	15.97^{b}	84.04^{a}	0.54^{ns}
'Kosari'	260.80^{a}	15.22^{b}	84.78^{a}	0.58^{ns}
'Anjiri-ye-tabestane'	100.20^{b}	16.36^{b}	83.63^{a}	0.46^{ns}
'Anjiri-ye maleki'	115.60^{b}	17.56^{ab}	82.44^{ab}	0.46^{ns}
'Anjiri-ye khouni'	113.20^{b}	20.56^{a}	79.44^{b}	0.45^{ns}
'Haj-kazemi'	127.30^{b}	14.52^{b}	85.48^{a}	0.54^{ns}
'Haste-joda'	130.80	15.43^{b}	84.57^{a}	0.51^{ns}

Each value represent the mean of 3 replicates, Means followed by the same letters are not significant different for p=0.05 in one-way ANOVA test

In general, results of current study revealed that 'Anjiri-ye-khouni' had the highest total soluble solid. Among these eight Iranian cultivars, the highest and lowest Vitamin C content was corresponded to 'Khouni-haste-joda' and 'Anjiri-ye maleki', respectively.

According to reports of Yoshida (1970) and Moing *et al* (1998) the pH of the Low Acidity peach fruits ranges above 4.0. Thus, 'Anjiri-ye -khouni' 'Anjiri-ye tabestane' and 'Anjiri-ye maleki' in grouping characterized as low acidity peach and other cultivars in current study are high acidity peaches.

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