INTERNATIONAL JOURNAL OF UNANI AND INTEGRATIVE MEDICINE

E-ISSN: 2616-4558
P-ISSN: 2616-454X
IJUIM 2018; 2(2): 05-09
Received: 02-02-2018
Accepted: 03-03-2018

Tabasum Fatima
Assistant Professor, Kashmir Tibbiya College, Hospital and Research Centre J & K, India

Omar Bashir
Phd Scholar, Division of Food Science and Technology, SKUAST Kashmir, India

GousiaGani
Phd Scholar, Division of Food Science and Technology, SKUAST Kashmir, India

Tashooq A Bhat
Phd Scholar, Division of Food Science and Technology, SKUAST Kashmir, India

Nusrat Jan
Phd Scholar, Division of Food Science and Technology, SKUAST Kashmir, India

Correspondence
Tabasum Fatima
Assistant Professor, Kashmir Tibbiya College, Hospital and Research Centre J & K, India

Nutritional and health benefits of apricots

Tabasum Fatima, Omar Bashir, Gousia Gani, Tashooq A Bhat and Nusrat Jan

Abstract
Advances in food and nutrition have shifted the consumer preferences towards functional and nutraceutical rich foods. In addition to natural antioxidant defence system, there are external sources furnished via diet to quench free radicals and reactive oxygen species produced in the biological systems. Apricot occupies a distinct position among stone fruits due to its multifaceted compositional contour and significant functional potentials. It has a rich nutritional content in terms of sugars (more than 60%) proteins (8%), crude fiber (11.50%), crude fat (2%), total minerals (4%), vitamins (vitamin A, C, K and B complex) and reasonable quantities of organic acids (citric acid and malic acid) on dry weight basis. Literature reports that there are appreciable amounts of total phenolic compounds and flavonoids in the fruit which make them more valuable as functional food. The fruit has a great market value as fresh and dried food commodity and has the highest market share of agricultural income. The plant is reported to contain polysaccharides, polyphenol, fatty acid, sterol derivatives, carotenoids, cynogenic glycosides and volatile component. In very small amounts, the hydrogen cyanide present in apricot kernels has been traditionally prescribed in Chinese medicine for treating asthma, cough, and constipation. Owing to its bioactive components of pharmacological importance, it has been found effective against chronic gastritis, oxidative intestinal damage, hepatic steatosis, atherosclerosis, coronary heart disease and tumor formation. The present review is an attempt to collect and disseminate available information regarding nutritional and health potentials in apricot for the benefit of researchers, consumers and other stakeholders.

Keywords: Apricots, bioactive composition, free radicals, functional foods, and phytochemicals

1. Introduction
Apricot (*Prunus armeniaca* L.) belongs to family Rosaceae. In angiosperms, Rosaceae is one of the largest families having about 3,400 species including almonds, peaches, apples, plums, cherries and berries, distributed throughout the northern temperate regions of the globe. Apricot has been named by Romans most probably from the mixed accent of two words “praecocia” from Latin meaning “early matured”, or “albarquq” from Arabic, meaning short ripening period. It is a temperate fruit and grown in climates with well-differentiated seasons. It requires a fairly cold winter and moderately high temperatures in the spring and early summer (Ahmadi *et al*., 2008; Guclu *et al*. 2009) [1]. The apricot tree is deciduous and needs a relatively cold winter for proper dormancy and flower bud development (400–600 hours below 7.2 °C during winter). The cultivation of apricots is not suitable in areas with a subtropical climate.

Botanically, apricots are drupes like peaches, plums, cherries and mangoes in which the outer fleshy part (exocarp and mesocarp) surrounds a hard stone (endocarp) with a seed inside. Fruit color ranges between orange to orange red and some cultivars are cream white to greenish white (Ruiz *et al*. 2008; Riu-Aumatell *et al*. 2009) [39, 41]. Apricot originated in China and Central Asia (Yuan *et al*., 2007) [47] and has been cultivated in china since 2000BC. It gradually made its way through the Persian Empire into the Mediterranean, where they were best adapted. This fruit has also been grown in mountainous slopes of Asia and Europe for thousands of years. Presently, the main apricot cultivation regions include a strip stretching from Turkey through Iran, the Himalayas, Hindukush to China and Japan. However, the largest production of world apricot is supplied from the Mediterranean countries (Leccese *et al.* 2007) [27]. According to FAO statistics (2010), the world’s largest producers are Turkey and Iran accounting for 21.6% and 14.7% of world apricot production respectively, followed by Pakistan, Uzbekistan, Italy, Algeria, Japan, Morocco, Egypt and Spain. It is consumed in fresh, dried and frozen forms or used for preparation of jam, jellies, and marmalades, pulp,

juices, nectars and extruded products (Chauhan *et al*.,2001) [13]. In addition, apricot kernels are considered to be an excellent source of quality oil, being used for cooking purpose, production of cosmetic products, benzaldehydes and active carbon. The current trends in nutrition sciences have attracted the consumers towards consumption of health foods especially fruits and vegetables to fulfil their nutritional needs and maintain a healthy life. The present paper therefore aims to explore and summarizes the available research information on apricot fruit regarding its nutritional and health benefits.

Nutritional Significance

Among stone fruits, apricot is a carbohydrate- rich commodity and is good source of fibers, minerals and vitamins. Carbohydrate concentration in fresh apricots ranges from 11-13% and provides 50 kcals of energy per 100g on fresh weight basis (Leccese *et al*. 2007) [27]. It is also rich in bioactive phytochemicals that have certain roles in the biological system and effective in preventing oxidative stresses (Leccese *et al*., 2011) [28]. Apricot also carries a reasonable amount of dietary fiber that ranges from 1.5-2.4g/100g on fresh weight basis (Ali *et al*. 2011) [4]. Fiber provides necessary roughage and bulk to the food consumed, stimulates normal gastric mobility and prevents constipation, as animal model studies of apricot fiber significantly improved faecal output (Akin *et al*. 2007; Tamura *et al*. 2011) [3, 44]. Soluble fiber lowers blood cholesterol, maintain blood sugar level and helps in reducing body weight. Apricots contain varied amounts of essential minerals The major elements are potassium, phosphorus, calcium, magnesium, iron and selenium (Munzuroglu *et al*., 2003; Ali *et al*.,2011) [4], while sodium, manganese, zinc and copper are also present in small amounts (Lichou *et al*., 2003; USDA, 2010) [30, 45]. Similarly, the vitamins found in apricot are pro- vitamin A, vitamins C, K, E, thiamin (B1), riboflavin (B2), niacin (B3), pyridoxine (B6), folic acid (B9) and pantothenic acid. Apricot contains organic acids i.e. malic acid (500-900mg/100g) and citric (30-50mg/100g) as the major acids (Gurrieri *et al*. 2001), while presence of tartaric, succinic, oxalic, galacturonic, quinic, malonic, acetic and fumaric acid has also been reported (Hasib *et al*., 2002) [20]. From a nutritional point of view, organic acids maintain acid base balance in the intestine and improve bioavailability of iron. Proteins and fats are found in minute quantities in the flesh; however, apricot kernel has appreciable amounts of the both, 20-30% and 40-52% respectively (Alpaslan and Hayta, 2006).Average ranges of protein and fat in apricot fruit is 1.4-2.0% and 0.4-0.6% respectively. The oil content of seed ranges from 40-52%, which is rich in unsaturated fatty acids (Alpaslan and Hayta, 2006) [6]

Phytochemicals in Apricot

Apricot fruit contain different levels of phytochemicals such aspolyphenols (phenolic acids and flavonoids) and carotenoids that contribute significantly to their taste, colour and nutritional value (Dragovic- Uzelac *et al*. 2007) [14].

Phenolic compounds

Phenolic compounds are important plant chemicals and play important roles in the living systems. There is considerable interest in polyphenols and carotenoids because of their antioxidant properties and possible ability to alleviate chronic diseases (Gardner *et al*. 2000) [16]. Apricots contain phenolic compounds (phenolic acids and flavonoids) and total phenolic composition has been reported in the range of 50.00-563.00mg GAE/100g on fresh weight basis (Ali *et al*. 2011) [4]. Their concentration normally increases with the maturity of fruit and attains maximum accumulation at fully ripened stage; however, some phenolic constituents decrease with the stage of maturity (Dragovic-Uzelac *et al*. 2007) [14]. Similarly, some studies have even shown high concentrations of phenolics in unripe fruits (Kalyoncu *et al*. 2009) [23]. The phenolic acids such as chlorogenic, neochlorogenic, isochlorogenic, caffeic, β- coumaric, p-coumaric and ferulic acids derivatives are the most common found in apricot (Sass-Kiss *et al*., 2005) [42]. Total flavonoid content determined in apricot has been reported in the range of 1.00- 12.00mg/100g on fresh weight basis (Miguel *et al*., 2008). The main flavonoids are flavanols, anthocyanins and flavonols respectively. Akbulut and Artik (2002) have reported catechins as the most common phenolic compound in apricots from Turkey. Similarly, chlorogenic acid has been reported as the major phenolic compound from Croatian apricots (Dragovic-Uzelac *et al*. 2007) [14]. Flavonoids in apricots mostly occur asglycosides and rutinosides of quercetin, kaempferol and rutin.

Carotenoids

Carotenoids are bioactive compounds and the most widespread group of pigments in nature and are present in all photosynthetic organisms. They are responsible for yellow to red colors of fruits and flowers (Rao and Rao, 2007) [38]. Carotenoids act as antioxidants through scavenging the reactive oxygen species that cause oxidative damage to living cells. They are possibly vital in preventing many human degenerative disorders and maintaining good health (Bramley, 2003) [10]. Apricot is among the carotenoid-rich fruits and the content ranges from 2.00-20.77mg/100g of β-carotene (Ali *et al*. 2011) [4]. The major dietary carotenoids are β-carotene, γ-carotene and lycopene, among them β-carotene represents more than 50% of total carotenoids. Other carotenoids reported in apricot fruit include, β-cryptoxanthin, lutein, phytoene, phytofluene and zeaxanthin. Apricot is an excellent source of β-carotene, the main carotenoid that is precursor of vitamin A and confers orange color to the fruits (Ruiz *et al*., 2005) [40]. Apricots can be important dietary sources of pro-vitamin A, because 250g of fresh or 30g of dried apricots supply enough carotenoids that fulfill the body requirements of vitamin A (Marty *et al*. 2005) [31].

Functional Properties of Apricot

There is an increasing demand by the consumers for foods that not only fulfill the basic need of nutrition but additionally perform a disease preventive and curing role. According to Karla (2003) [25], "functional foods aid in the prevention and treatment of diseases". The food components meeting this purpose are mostly phytochemicals that are being explored and studied for their potential roles in the body. These compounds alleviate risk of free radicals that cause oxidative damage to the living cells and result into common degenerative disorders like cancer and cardiovascular diseases (Boyer and Liu, 2004) [4]. Amongst, phenolic compounds are considered to be very important as antioxidants. Their antioxidant properties include; anti-carcinogenic, anti-oxidant, anti- tumoral, anti-microbial,

anti-aggregant, anti- ischemic, anti-allergic, anti-mutagenic and anti-inflammatory as well as effective in alleviating cardiovascular diseases. Furthermore, certain functional foods have been associated with improved mental capacity (Howlett, 2008) [21], immunity and with anti-ageing benefits. Apricot fruit in this context may be considered as a functional food having appreciable amounts of biologically active phytochemicals.

Antioxidant capacity of apricot

Oxidative stresses, due to production of reactive oxygen species and free radicals cause damage to macromolecules (protein, lipids and nucleic acids) and tissue injuries. These conditions further lead to pathogenesis and chronic disorders, including cancer, inflammations, ulcers, diabetes and cardiovascular diseases (Halliwell and Aruoma, 1991) [21]. The antioxidant properties of apricot fruit are attributed to its rich phytochemical composition. Numerous studies have revealed the potential of apricot to be considered as a functional food based on its free radical scavenging activities (Leccese *et al*. 2007) [27].

Apricot as folk medicine

Apricot has been used as a popular home remedy in China and among the mountainous inhabitants of Himalayas for centuries. The folk describes apricot as analgesic, anthelmintic, antiasthmatic, antipyretic, antiseptic, antispasmodic, demulcent, emetic, emollient, expectorant, laxative, ophthalmic, pectoral, sedative, tonic and vulnerary. Apricot fruit in Chinese medicine is thought to be useful in regenerating body fluids, detoxifying and quenching thirst, while kernels for toning respiratory system and alleviating cough (Kan and Bostan, 2010) [24].

Role of apricot in degenerative diseases

Cancer

Cancer is the most common degenerative disease today and the second cause of deaths in the USA after cardiovascular diseases (Borek, 2004) [8]. A number of pharmacological or physiological factors are responsible for the incidence of apoptosis (Noonan *et al*. 2007) [36]. Neuhouser (2004) [35] reviewed association of flavonoid intake with cancer insurgence and concluded that there is substantial evidence regarding the role of flavonoids in reducing the risk of lung cancer. Apricots in a number of studies have shown anti-carcinogenic potential. Enomoto *et al*., (2010) [15] have established that consumption of 3 Japanese apricots daily has an inhibitory effect on mucosal inflammation in the stomach and chronic gastritis progressions related to Helicobacter pylori infection. Miyazawa *et al*., (2006) [33] investigated the role of (+)- Syringaresinol, a compound isolated from unripe Japanese apricot in the motility inhibition of H. Pylori. Similarly, fruit juice concentrates of Japanese apricot prevented H. pylori induced glandular stomach lesions in Mongolian Gerbils (Otsuka *et al*., 2005) [37]. A compound extracted from a Japanese apricot variety "MK615" has also shown anti-tumor activity against human pancreatic cancer cells, colon cancer cells and liver cancer cells in laboratory trials. Apricot and other prunacian family seeds have been used in a number of pathological disorders like asthma, bronchitis, emphysema, leprosy, colorectal cancer, leucoderma and pain (Chang *et al.* 2005) [12]. The oil of apricot was also used in England during the 17th century to treat ulcers and tumors (Lewis *et al*. 2003) [29]. Human studies on the effect of aqueous amygdaline extracts from Armeniacae semen have shown apoptotic cell death of prostate cancer (Chang *et al.* 2006).

Cardiovascular diseases

Cardiovascular diseases are among the main causes of deaths all over the world. Associated risk factors include high cholesterol, high homocysteine level, atherosclerosis and many others (Schieber *et al*. 2001). Antioxidants have been found effective in combating coronary heart diseases (CHD). Phenolic components in apricots i.e. chlorogenic acid, β-carotene and lycopene prevent the oxidation of low density lipoprotein (LDL) and thus improve the antioxidative status of the body (Chang *et al*. 2006) [11]. Apricot supplies significant amounts of fiber (soluble and insoluble) (Ishaq *et al*. 2009) [22]. Soluble dietary fiber is effective in reducing LDL cholesterolby binding bile acids or cholesterol during intraluminal micelles formation; thus decreasing the content of cholesterol in liver cells and increasing clearance of LDL cholesterol (Aller *et al*.,2004) [5].

Hepatic steatosis

Hepatic steatosis is mainly resulted from intra- cytoplasmic accumulation of neutral fats in the liver tissues and is called as fatty liver disease (FLD). The occurrence of this disease in the general population may further lead to steatohepatitis, advanced fibrosis and cirrhosis (Angulo, 2002) [7]. Apricot has been shown to be effective in curing hepatic steatosis in animal models.

Hemostasis

Several epidemiological studies have shown that intake of dietary flavonoids and flavones are inversely associated with the risk of cardiovascular disease (Neuhouser, 2004) [35].This may be due to the effect of these compounds on hemostasis, because flavonoids have been reported to inhibit platelet aggregation in vitro. Raw apricots contain 5.47 mg/100 g of flavon- 3-ol (-) epicatechin, 4.79 mg/100 g of flavon-3- ol (+) catechin and 2.08 mg/100 g of edible portion of flavonol (USDA, 2007) and studies have revealed that 2500 micromol/L of the flavonolquercetin and the flavone apigenin significantly inhibited collagen-induced and ADP-induced aggregation in platelet-rich plasma.

Conclusion

The scientific evidence reviewed regarding apricot's nutritional and functional attributes reveals that it is a rich source of nutrients and biologically active compounds. These substances have crucial roles in disease prevention and health maintenance. The effectiveness of apricot against stomach inflammations, hepatic disorder, tumour formation and chronic heart disease suggests its use as a functional food. The present review in this regard will help researchers as a ready reference for further nutraceutical studies and entrepreneurs for industrial exploitation of the fruit for economic benefits.

References

1. Ahmadi H. Fathollahzadeh H, Mobli H. Some physical and mechanical properties of apricot fruits, pits and kernels (C.V Tabarzeh). American-Eurasian Journal of Agriculture and Environmental Science. 2008; 3(5):703-707.

2. Akin EB, Karabulut I, Topcu A. Some compositional properties of main Malatya apricot (*Prunus armeniaca*.) varieties. Food Chemistry. 2008; 107:939-948.
3. Akin EB, Karabulut I, Topcu A. Some compositional properties of main Malatyaapricot (*Prunus armeniaca* L.) varieties. Food Chemistry, 2007; 107(2):939-948.
4. Ali S, Masud T, Abbasi KS. Physico-chemical characteristics of apricot (*Prunus armeniaca* L.) grown in Northern Areas of Pakistan. Scientia Horticulture, 2011; 130(2):386-392.
5. Aller R, de Luis DA, Izaola O, La Calle F, del Olmo L, Fernandez L. Effect of soluble fiber intake in lipid and glucose levels in healthy subjects: a randomized clinical trial. Diabetes Research Clinical Practices. 2004; 65:7-11.
6. Alpaslan M, Hayta M. Apricot Kernel: Physical and Chemical Properties. Letters to the editor. Journal of American Oil Chemistry Society. 2006; 83(5):469-471.
7. Angulo P. Non-alcoholic fatty liver disease. The New England Journal of Medicine. 2002; 346: 1221- 1231.
8. Borek C. Dietary antioxidants and human cancer. Integrated Cancer Therapy. 2004; 3(4):333-341.
9. Boyer J, Liu RH. Apple phytochemicals and their health benefits. Nutritional Journal. 2004; 3:5-19.
10. Bramley PM. In I Johnson, GP Williamson. (Eds.), phytochemical functional Foods Boca Raton: CRC. Press. 2003.
11. Chang HK, Shin MS, Yang HY, Lee JW. Kim YS, Lee MH. Amygdalin Induces Apoptosis through Regulation of Bax and Bcl-2 Expressions in Human DU145 and LNCaP Prostate Cancer Cells. Biological and Pharmaceutical Bulletin. 2006; 29(8):1597-1602.
12. Chang HK, Yang HY, Lee TH, Shin MC, Lee MH, Shin MS. *et al*. Armeniacae semen extract suppresseslippolysaccharide-induced expressions of cyclooxigenase-2 and inducible nitric oxide synthase in mouse BV2 microglia cells. Biological and Pharmaceutical Bulletin. 2005; 28:449-454
13. Chauhan SK, Tyagi SM, Singh D. Pectinolytic liquefaction of apricot, plum, and mango pulps for juice extraction. International journal of Food Properties, 2001; 4(1):103-109.
14. Dragovic-Uzelac, V, Levaj B, Mrkicm V, Bursac D, Boras M. The content of polyphenols and carotenoids in three apricot cultivars depending on stage of maturity and geographical region. Food Chemistry. 2007; 102:966-975.
15. Enomoto S, Yanaoka K, Utsunomiya H, Niwa T, Inada, K. Deguchi, H. Inhibitory effects of Japanese Apricot, (*Prunus mume* Siebold ET Zucc.; Ume),on Helico pylori-related chronic gastritis. European Journal of Clinical Nutrition. 2010; 64: 714-719.
16. Gardner PT, White TA, Mc Phail DB, Duthie GG. The relative contributions of vitamin C, carotenoids and phenolics to the antioxidant potential of fruit juices. Food Chemistry. 2000; 68:471-474.
17. Guclu K, Altun M, Ozyurek M, Karademir SE, Apak R. Antioxidant capacity of fresh, sun-dried and sulphited Malatya apricot (*Prunus armeniaca* L) assayed by CUPRAC, ABTS/TEAC and folin methods. International Journal of Food Science and Technology, 2006; 41(1):76-85.
18. Gurrieri F, Audergon JM, Albagnac G, Reich M. Soluble sugars and carboxylic acids in ripe apricot fruit as parameters for distinguishing different cultivars. Euphytica. 2001; 117:183-189.
19. Halliwell B, Aruoma OI. DNA damage by oxygen-derived species: its mechanisms and measurement in mammalian systems. FEBS Letters. 1991; 281:9-19.
20. Hasib A, Jaouad A, Mahrouz M, Khouili M. HPLC determination of organic acids in morocan apricots. Cienc Technol Aliment, 2002; 3(4):207-211.
21. Howlett J. Functional Foods: From Science to Health and Claims. ILSI Europe Concise Monograph Series. 2008, 19.
22. Ishaq S, Rathore HA, Majeed S, Awan S, Shah SZA. Studies on the physico-chemical and organoleptic characteristics of apricot (*Prunus armeniaca* L.) produced in Rawalakot, Azad Jammu and Kashmir during storage. Pakistan Journal of Nutrition. 2009; 8(6):856-860.
23. Kalyoncu IH, Akbulut M, Coklar H. Antioxidant capacity, total phenolics and some chemical properties of semi-mature apricot cultivars grown in Malatya, Turkey. World Applied Science. 2009: 6(4):519-523.
24. Kan T, Bostan SZ. Changes of Contents of Polyphenols and Vitamin a of Organic and Conventional Fresh and Dried Apricot Cultivars (*Prunus armeniaca* L.). World Journal of Agricultural science. 2010; 6(2):120-126,
25. Karla EK. Nutraceutical-Definition and Introduction. AAPS, Pharmaceutical Science. 2003; 5(3):1-2.
26. Kim DO, Jeong W, Lee SCY. Antioxidant capacity of phenolic phytochemicals from various cultivars of plums. Food Chemistry. 2003; 81:321-326.
27. Leccese A, Bartolini S, Viti R. Total antioxidant capacity and phenolics content in apricot fruits International Journal of Fruit Science. 2007; 7(2): 3-16.
28. Leccese A, Viti R, Bartolini S. The effect of solvent extraction on antioxidant properties of apricot fruit. Central European Journal of Biology, 2011; 6(2):199-204.
29. Lewis WH, Elvin-Lewis MPF. Medicinal Botany: plants affecting human health. Hoboken, New Jersey; John Wiley & Sons, 2003, 214.
30. Lichou, J, Jay M, Vaysse P, Lespinasse N. Reconnaitre les variétésd, abricots. Editions Ctifl, France, 2003, 17-29
31. Marty I, Bureau S, Sarkissian G, Gouble B, Audergon JM, Albagnac G. Ethylene regulation of carotenoid accumulation and carotenogenic gene expression in colour-contrasted apricot varieties (*Prunus armeniaca* L). Journal of Experimental Botany. 2005; 56:1877-1886.
32. Miguel G, Dandlen S, Neves A, Antunes D. Flavonoids content of different apricot (*Prunus armeniaca* L.) cultivars. 4th IASME/WSEAS International Conference on Energy, Environment, Ecosystems and Sustainable Development (EEESD'08). Algarve, Portugal, 2008, 11-13.
33. Miyazawa M, Utsunomiya H, Inada K, Yamada T, Okuno Y. Tanaka. Inhibition of Helicobacter pylori Motility by (+)-Syringaresinol from Unripe Japanese Apricot. Biological and Pharmaceutical Bulletin, 2006; 29(1):172-173.
34. Munzuroglu O, Karatas F, Geckil H. The vitamin and selenium contents of apricot fruit of different varieties cultivated in different geographical regions. Food Chemistry. 2003; 83:205-212.

35. Neuhouser ML. Dietary flavonoids and cancer risk: evidence from human population studies. Nutrition and Cancer, 2004; 50:1-7.
36. Noonan DM, Benelli R, Albini A. Angiogenesis and cancer prevention. A vision. Recent results. Cancer Research, 2007; 174: 219-224.
37. Otsuka T, Tsukamoto T, Tanaka H, Inada K, Utsunomiya H, Mizoshita T. *et al*, Suppressive effects offruit-juiceconcentrate of prunus mumesieb. etzucc. (Japanese apricot, ume) on Helicobacter pylori induced glandular stomach lesions in mongolian gerbils.Asian Pacific Journal of Cancer Prevention. 2005; 6:337-341.
38. Rao AV, Rao LG. Carotenoids and human health. Pharmacological Research. 2007; 55:207-216.
39. Riu-Aumatell M, Lopez-Tamames E, Buxadera S. Assessment of the volatile composition of juices of apricot, peach, and pear according to two pectolytic treatments. Journal of Agricultural and Food Chemistry. 2005; 53:7837-43.
40. Ruiz D, Egea J, Tomas-Barberan FA, Gil MI. Carotenoids from new apricot (*Prunus armeniaca* L.) varieties and their relationship with flesh and skin color. Journal of Agricultural and Food Chemistry, 2005; 53:6368-6374.
41. Ruiz D, Reich M, Bureau S, Renard CMGC, Audergon J. Application of reflectance colorimeter measurements and infrared spectroscopy methods to rapid and nondestructive evaluation of carotenoids content in apricot (*Prunus armeniaca* L.). Journal of Agricultural and Food Chemistry. 2008; 56:4916-4922.
42. Sass-Kiss A, Kiss J, Milotay P, Kerek MM, Toth-Markus M. Differences in anthocyanin and carotenoid content of fruits and vegetables. Food Research International. 2005 38; 1023-1029.
43. Schieber A, Stintzing FC, Carle R. By-products of plant food processing as source of functional compounds-recent developments. Trends in Food Science and Technology. 2001; 12:401-13.
44. Tamura M, Ohnishi Y, Kotani T, Gato N. Effects of new dietary fiber from Japanese apricot (*Prunus mume* Sieb. etZucc.) on gut function and intestinal microflorain adult mice. International Journal of Molecular Science. 2011; 12:2088-2099.
45. USDA. Department of Agriculture Nutrient Data Laboratory 2010: USDA database for the oxygen radical absorbance capacity (ORAC) of selected foods, Release. 2010.
46. USDA. United States Department of Agriculture. Database for Flavonoid Content of Selected Foods.www.nal.usda.gov/fnic/foodcomp/Data/Flav/Flav02-1.pdf. 2007. Accessed on 13-5-1. 2007.
47. Yuan Z, Chen X, He T, Feng J, Feng T, Zhang C. Population genetic structure in apricot (*Prunus armeniaca* L.) cultivars revealed by fluorescent-AFLP markers in Southern Xinjiang, China. Journal of Genetics and Genomics. 2007; 34:1037-1047.