

Plums: A Brief Introduction

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Abstract

Plums are important source of compounds influencing human health and preventing the occurrence of many diseases. Plums have abundance of bioactive compounds such as phenolic acids, anthocyanin's, carotenoids, flavanols, organic acids, (e.g., citric and malic acids), fibre (pectin), tannins, aromatic substances, enzymes, minerals (e.g., potassium, phosphorus, calcium and magnesium, organic) and vitamin A, B, C & K. The predominant phenolic compounds in plums are caffeic acid, 3-O-caffeicquinic (neochlorogenic acid), 5-O-caffeicquinic (chlorogenic acid) and 4-O-caffe-icquinic (crypto-chlorogenic acid). Plums are being used in Indian medicine as a component of natural drugs used in case of leucorrhoea, irregular menstruation and miscarriage. Plum helps in prevention of heart disease, lung and oral cancer, lower the blood sugar, blood pressure, Alzheimer's disease, muscular degeneration, improve memory capacity, boost bone health, regulates the functioning of the digestive system and so on. Incorporation of plums in dairy and food products like Yoghurt, Pies, Biscuits, Lassi, Ice cream etc., in form of extract, pulp, powder or dried chunks would surely boost up the nutritional and flavour quality.

Keywords: Phenols; Anthocyanin's; Nutrition

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Introduction

Plums are one of the most important stone fruits crops of the world. Plums also include several familiar stone fruits- apricot, cherry and peach. There are more than 2000 varieties of plums, among which relatively few are of commercial importance [1]. These are grown in temperate zone in which China, Romania and U.S.A are leading countries for the production of plums [2].

Plums are important source of compounds influencing human health and preventing the occurrence of many diseases [3]. These are mostly consumed fresh all over the world. The processing of plums is generally relies on drying of fresh plum, canning and beverage preparation. Although sun drying was very common earlier, today plums are mostly dehydrated [4]. Plums have high sugar content, so to maintain the nutritional and sensory quality, dehydration to desired moisture content, sub atmospheric conditions are desirable. Different conventional and novel drying techniques are applied for drying of plums such as hot air drying, sun drying, vacuum drying, microwave drying, high pressure assisted drying and osmotic dehydration. Drying of plums is usually done for attainment of low microbial loads and to make more stable product to provide stability throughout the year.

Increased competition in today's global market refers avenues

to improve the process efficiency and desirable product quality. So, for increased globalization and consumer awareness it is necessary to minimize the detrimental effects such as physical and chemical changes during of plums. In traditional air drying process plums undergo oxidative damage, browning, loss of flavour and shrinkage, which lead to lower sensory and nutritional quality of the products. To improve product quality and reduce drying time, osmotic dehydration can be an advantageous method for plum drying. It is a pre-treatment for fruits and vegetables prior to drying [5] and other heat assisted processing like canning, freezing, and minimal processing as osmotic dehydration does not lowers the product moisture [6].

The purpose of this paper is to review the physical characteristics, health benefits, nutritional and antioxidant properties of plums.

Historical Background

With many know varieties of plums, it is not surprising that it has different heritages and places of origin in all over the world. The practice of cultivation has been done since prehistoric times, longer perhaps than any other kind of fruit except the apple. Earliest known data of plums says that plums are origin of China, 470 BC. The European plums are thought to have been discovered around two thousand years ago, originating in the

area near the Eastern Europe or Western Asia. In ancient Roman times, 300 varieties of European plums were mentioned. The pilgrims introduced the European plums to United States in 17th century. Japanese plums actually originated in China rather than Japan. It was introduced to Japan 200-400 years ago [7], from which it disseminated around the world. Plums may have been one of the first fruits domesticated by humans. Plum remains have been found in Neolithic age archaeological sites along with olives, grapes and figs. Today plum is cultivated in all temperate climate countries of the world. Europe first bred European plum (*Prunus domestica*), America first had the American plum (*Prunus Americana*), South Asia cultivated the cherry plum (*Prunus cerasifera*), and Western Asia is having the Damson plum (*Prunus salicina*).

Characteristics of Plums

Plums are a drupe fruit of the subgenus *Prunus* of the genus *Prunus*. Weinberger, (1975) reported nearly 2000 species in genus *Prunus*. They come in a wide variety of size and colors like yellow, white, green or red flesh. Mature plum fruit may have a dusty-white coating that gives them a glaucous appearance [8] (Table 1).

Plums have abundance of bioactive compounds such as phenolic acids, anthocyanins, carotenoids, minerals and pectins. For many decades plums have been used in Indian medicine as a component of natural drugs used in case of leucorrhoea, irregular menstruation and miscarriage [9]. Nutrients present in plum determine nutritive value and taste of plums [10].

Nutritional Value of Plums

Plums have abundance of bioactive compounds such as phenolic acids, anthocyanins, carotenoids, minerals and pectins. Plums constitute a valuable component of our diet, both in terms of their nutritive and dietary value. These fruits are becoming an increasing popular object of nutritional studies conducted on humans and animals, assessing the effect of plum consumption on the functioning of the organism. For many decades plums have been used in Indian medicine as a component of natural drugs used in case of leucorrhoea, irregular menstruation and miscarriage [11]. Plums have low calorie content and relatively high nutritive value. They contain carbohydrates, first of all sucrose, glucose and fructose, organic acids, e.g., citric and malic acids, fibre (pectins), tannins, aromatic substances and enzymes. Contents of minerals in plums increase as fruits ripen. These substances determine nutritive value and taste of plums [10].

Antioxidant and Total Phenolic content of Plums

Phenolic compounds are fascinating and unique class of bioactive compounds widely spread throughout nature. Because of their richness in health-promoting components and preventing of the occurrence of several diseases as well as their excellent nutrients content [12], there has been great interest in ascertaining the total antioxidant capacities (TAC) and total phenolic content (TP)

of plums in recent years [13]. These fruits constitute rich source of antioxidant compounds, such as phenolic acids, anthocyanins and other flavonoids [11,14].

The predominant phenolic compounds in plums are derivatives of caffeic acid: 3-O-caffeoylquinic (neochlorogenic acid), 5-O-caffeoylquinic (chlorogenic acid) and 4-O-caffeoylquinic (cryptochlorogenic acid) as well as caffeic acid, together with smaller amounts of anthocyanins, flavanols and flavonols [11].

According to literature data, depending on the variety, environmental conditions and applied analytical methods, contents of phenolic acids in plums fall within a wide range of values (Table 2) [9,15-17].

Fruit processing affects polyphenol contents and alters fruit microstructure, resulting in the loss or enrichment of some polyphenols and influencing their access and availability [18-21] (Table 3).

Health-Promoting Properties of Plums

Numerous studies confirmed the health-promoting action of plums as a dietary component. Followings are summarized some health benefits of plums (Table 4).

Processing of Plums

There is old saying that "All dried plums are prunes but not all plums are prunes". Plums with high sugar content and firm flesh dried without removal of stone and are called prunes [7]. Plums are being processed in different kind of products and are

Table 1 Scientific classification of Plums.

Kingdom	Plantae
Order	Rosales
Family	Rosaceae
Subfamily	Amygdaloideae
Genus	<i>Prunus</i>
Subgenus	Prunus

Table 2 Phenolic components present in plums.

Acids	Quantity (mg/kg)
Neochlorogenic acid	85-1300 mg/kg
Chlorogenic acid	13-430 mg/kg
Cryptochlorogenic acid	956 mg/kg

Table 3 Content of Anthocyanin's in Plum Fruits.

Component	Range (mg/100g f.w)
Cyanidin-3-glucoside	1.9-13.5
	1.4-14.4
Cyanidin-3-rutinoside	14.1-33.0
	8.9-60.5
Peonidin-3-glucoside	1.1-1.2
	0.3-2.3
Total anthocyanins	926
	125
	76
	18-29

Table 4 Health benefits.

Sr. No.	Health Benefits
1.	Regulates the functioning of the digestive system and thereby relieve constipation conditions due to the presence of dietary fiber, sorbitol, and isatin.
2.	Vitamin C helps the body to develop resistance to infectious agents and scavenges harmful free radicals.
3.	Fresh plums, like yellow Mirabelle have moderate vitamin A and beta carotene content. Natural fruit's vitamin A protect from lung and oral cancer.
4.	Plums have significant amount of health promoting carotenoids such as lutein, cryptoxanthin and zeaxanthin. These compounds are one kind of scavengers against aging and disease causing oxygen-derived free radicals and reactive oxygen species. Zeaxanthin provide antioxidant and protective UV light-filtering functions.
5.	Plums are rich source of potassium, fluoride and iron. Potassium as an important component of cell and body fluids, helps in controlling heart rate and blood pressure
6.	In addition, the plums are moderate sources in vitamin B-complex groups such as niacin, vitamin B-6 and pantothenic acid and these vitamins help the body metabolize proteins, carbohydrates and fats. Plums also provide about 5% RDA levels of vitamin K. Vitamin K is important for clotting factors function in the blood as well as in bone metabolism and help reduce Alzheimer's disease in the elderly.
7.	Consumption of plums prevents macular degeneration, heart diseases and also damage to our neurons and fats that form a part of our cell membranes

used increasingly as food ingredients by food processors. Some of types are dried prunes, prune juice, prune juice concentrate, canned prunes, plum juice, plum paste, prune powder, prune fibre, low moisture prune granules, low moisture prune bits, jam and jelly, fresh-cut plums [22].

Production of dried plums

Prunes are the dried fruits of some cultivars of *Prunus domestica* L. that originated from the Caucasus region in Western Asia [9]. In 1856, Frenchmen Louis Pellier introduced the *La Petite d'Agen* prune, a native of southwest France, to the Santa Clara Valley of California. Today modern dehydrators have replaced the old methods of drying prunes in the sun in the United States [23] (**Flowchart 1**).

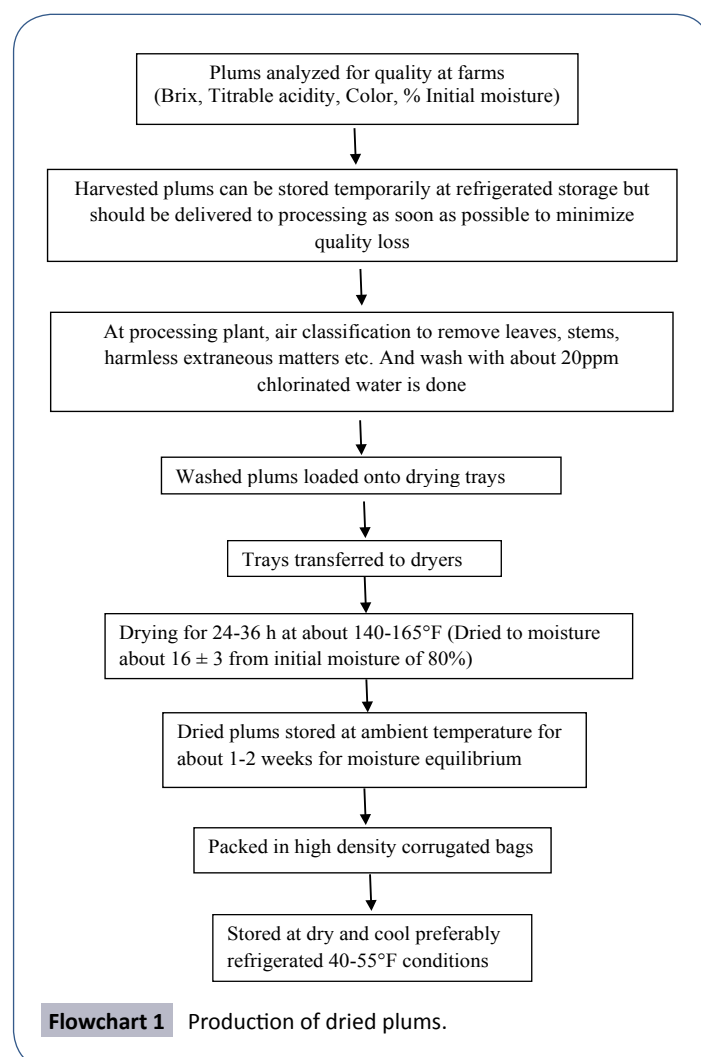
Now day's prunes are dried in long tunnel dehydrator. Fruits are dried to about 18% moisture, which has sufficiently low-water activity to avoid problems of microbial spoilage allowing long term storage [24]. Generally, forced-draft tunnel dehydrators are used for drying plums, with a total drying process time of 24–36 h, depending on the size and soluble solids contents of the prunes.

Yield of dried prunes is about 33%. Conventional dried prunes are sometimes dried to very low moisture content in vacuum shelf drier [23]. The finished low moisture dried plums contain less than 4% moisture. Because of high sugar content of dried plums, dehydration to such a low moisture level can be achieved only under sub-atmospheric conditions. About 75% of world's supply of dried prunes is produced in California and in the Pacific Northwest. Prunes are important product of dried fruits industry. The process of drying fresh fruits to produce dried plums on a large scale was practised in Europe, primarily in France, Italy, and Austria, before the prune industry commenced in the U.S. Prunes are also products with an advantageous nutritive and dietary value, whose popularity as a wholesome snack has increased considerably in recent years [25].

Consumer Perception

Marketers believe that the term dried plum has a more positive

image to customers than dried prunes. In a study plums scored higher on the following perceptions of healthiness compared to dried fruits: more natural, easier to digest, containing more vitamins, and eaten instead of candy [26]. About one-half of the plums are consumed fresh while the rest are processed. According to Somogyi and Luh [23], marketers believe that the



term “dried plum” has a more positive image to the consumers than “prunes,”

In a study plums scored higher on the following perceptions of healthiness compared to dried fruits: more natural, easier to digest, containing more vitamins, and eaten instead of candy [26]. Different kind of drying techniques are applied for drying plums like hot air drying, sun drying, ultra sound assisted drying,

high pressure assisted drying, vacuum drying, microwave drying, and osmotic dehydration. Traditional air drying produces detrimental effects on the quality of fruits, mainly oxidative damage, browning, loss of flavour and extensive shrinkage, which reduce sensory and nutritional quality of the products [27,28]. Some other techniques were adopted to minimize the nutritional losses; osmotic dehydration is one of them [29,30].

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