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Some physical and chemical parameters of wild medlar (*Mespilus germanica* L.) fruit grown in Turkey

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Abstract

Physical and chemical parameters of medlar fruit are necessary for the design of equipment to handle, harvest, process, store the product and nutrition values. In this study, the medlar (*Mespilus germanica* L.) fruit was studied to determine for some physical (dimension, geometric mean diameter, sphericity, bulk density, fruit density, volume, hardness and porosity) and chemical (moisture, crude protein, oil, energy, fibre and ash, pH, acidity, water-soluble extract, alcohol-soluble extract and ether-soluble extracts) properties. Moisture, crude oil, protein, fibre, energy, and ash, acidity, pH, water-soluble extract, alcohol-soluble and ether-soluble were found to be 72.15%, 4.09%, 3.71%, 11.4%, 16.5 kcal/g, 1.96%, 0.28%, 4.26, 68.89%, 53.35% and 2.41% (dry basis (except for pH)), respectively. Inductively coupled plasma atomic emission spectrometer (ICP-AES) determined the mineral content of medlar fruit. Potassium (8052.91 mg/kg) was present in the highest concentration, following S, Ca, B and P. Also, K, S, Ca, B and S were present in higher concentrations, and traces of Cr, Ti and V were also determined. The fruit mass, diameter, volume, geometric mean diameter, sphericity and projected area were measured as 11.98 g, 27.68 mm, 13.68 cm^3, 28.86 mm, 0.92, and 9.25 cm^2, respectively. The changes in physical and chemical properties of fruits having about the same size were probably due to environmental conditions in conjunction with the analytical methods used. Consequently, the analytical values showed rich nutritional properties and mineral contents of medlar fruits. Also, the mineral content of medlar fruit is of great interest. In addition, knowledge of the physical properties of equipment used in planting, harvesting, transportation, storage and processing of matured medlar fruits is very important.

Keywords: Medlar; Fruits; *Mespilus germanica* L.; Physical and chemical parameters; Minerals

1. Introduction

Medlar is the fruit of *Mespilus germanica* L. in the family of Rosaceae. It grows poorly in frost-free areas, and on rocks and in poor soils. Medlar grows wild in various regions (especially in north and west-Anatolia and Marmara regions) of Turkey (Browicz, 1972; Glew et al., 2003a). It grows to about 6–7 m. Medlar has elongated leaves and the leaves and flowers are similar to that of apple. The fruits are subglobose, large, about 5 cm across, and brown when ready to eat. The central cavity is filled with flat, circular, yellowish or brown seeds 3/8–1/2 in. (1–1.25 cm) long, enclosed in grayish-yellow, mucilaginous membranes arranged in rows around a central fleshy core. Harvest takes place from October, storing part of the crop in cold, dark, and aerated places, to induce the fruit to soften. The most common use of fruits is for raw consumption. The collection of medlar fruits at the physiological ripening stage and their storage in straw until over-ripening are well-known traditions, still alive today (Glew et al., 2003a, 2003b).

The flavor is described as rich, cidery and wine-like, and also resembles that of dried apples or quinces.

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Nomenclature

D	diameter of medlar	q	torque arm (cm) (10.5 cm)
D_g	geometric mean diameter (mm)	T_a	initial torque value (N cm)
L	length of medlar (mm)	T_m	average value of the torque (N cm)
M	mass of medlar (g)	V	volume of medlar (cm^3)
m_c	moisture content, (%) d.b.	V_t	terminal velocity (m/s)
ε	porosity of medlar (%)	W	sample weight (10 N)
P_a	projected area (cm^2)	$\varnothing$	sphericity of medlar
ρ_b	bulk density (kg/m^3)	μ_s	static coefficient of friction
ρ_f	fruit density (kg/m^3)	μ_d	dynamic coefficient of friction

Several common varieties of medlar plant are well-known throughout Europe and Asia (Anonymous, 2004a; Aydın & Kadıoğlu, 2001; Glew et al., 2003a; Janick & Moore, 1996; Özbek, 1978). In general, ripening occurs late in medlars. The fruit of medlars are used as a nutrition material by the local customer and are consumed by the local people as marmalade. The medlar fruit is also used as treatment of constipation, diuretic, and to rid the kidney and bladder of stones (Baird & Thieret, 1989; Baytop, 1999; Glew et al., 2003a).

The medlar fruit has been of recent interest for its edible fruits. The fruits contain sugar, organic acid, amino acids and tannins. Fructose, glucose and sucrose were identified as the principal sugars and their levels varied remarkably during development (Baytop, 1984; Glew et al., 2003b). Fatty acids in medlar (*M. germanica* L) mesocarp at different stages of ripening were measured, and were found to be mainly palmitic acid, linoleic acid and α-linolenic acid (Ayaz et al., 2002a, Ayaz, Huang, Chuang, Vanderjagt, & Glew, 2002b). In other studies, changes in the activities of polyphenol oxidase and peroxidase as well as in the levels of soluble protein, soluble sugar, and ascorbic acid during the development and ripening stages of medlar fruits were investigated. One of the major medlar fruit quality problems is flesh browning associated with the enzyme polyphenol oxidase (Aydın & Kadıoğlu, 2001; Mathew & Parpia, 1971). On the other hand, biochemical studies of fruits indicate that levels of organic and amino acids, sugars, soluble solids and mineral contents are the primary quantitative parameters (Glew et al., 2003a, 2003b, 2003c; Senter & Callahan, 1990).

The fruit is consumed as a medicinal remedy in Turkey. In 1964, two new antibiotic cyclopentoid monoterpenes were isolated and identified. These were genipic acid and genipinic acid, its carbomethoxyl derivative (Anonymous, 2004b; Baytop, 1984).

Limited studies on physical and chemical properties of medlar fruits have been performed hitherto. Especially, the physical properties of equipment used in planting, harvesting, transportation, storage and processing of medlar fruit must be known. The aim of this work is to establish the physical and chemical properties of wild medlar fruits.

2. Material and methods

2.1. Material

Ripe medlar (*M. germanica* L.) fruits were used for all the experiments in this study. Fruits were separated into three mature groups for analyses. Fruits were randomly collected from 20 trees from Eğirdir (Isparta) in the morning during the autumn season (November) of 2003. They were growing at 918 m above sea level. Total fruit weights were 50 kg. They were kept in cooled bags (10 °C) for transport to the laboratory, and were transported at 4 p.m. The fruits were cleaned to remove all foreign matter such as dust, branches, leaves, immature and damaged fruits. The remaining fruit was packed in a 3000 ml hermetic glass vessel and kept in cold storage (−18 °C) until use.

2.2. The chemical analyses

The nutritional properties of fruits were determined by the method of AOAC (1984) and Cemeroğlu (1992). The initial moisture content of fruits was determined by using a standard method (Brusewitz, 1975). After the fruits were prepared for proximate analyses, all minor elements were determined using an ICP-AES (Vista series, Varian International AG, Switzerland). The properties of this Instrument were as outlined by Skujins (1998). The samples were analyzed for crude energy with an adiabatic oxygen bomb calorimeter. Triplicate samples were used to establish the chemical composition.

2.3. Mineral content analyses

About 0.5 g of dried and ground sample was put into a burning cup and 10 ml pure HNO_3 was added. The