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FATTY ACID PROFILE OF FRESH AND DRIED BANANA *(MUSA SAPIENTUM* L. VAR. *CAVENDISHII* Lamb.) PEEL OILS

TAZE ve KURUTULMUŞ MUZ *(Musa sapientum* L. var. *cavendishii* Lamb.) KABUK YAĞLARININ YAĞ ASİTİ PROFİLİ

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ABSTRACT

Fatty acid compositions of the fixed oils obtained from the dried and fresh fruit peels of Musa sapientum var. cavendishii (Musaceae) were examined by capillary GC-MS. Both of the oils were found to contain palmitic acid as the major saturated fatty acid along with linoleic and linolenic acids as the mean unsaturated components, which are key fatty acids for human health, as well as the other saturated fatty acids, namely caprylic, capric, lauric, myristic, stearic, and arachidic acids in minor amounts.

Keywords: Musa sapientum, Musaceae, banana, fixed oil, fatty acid, GC-MS

ÖZET

Musa sapientum var. *cavendishii*'nin (Musaceae) kurutulmuş ve taze meyve kabuklarından elde edilen sabit yağların yağ asiti kompozisyonları kapiller GC-MS ile incelendi. Yağların her ikisinin de, minör miktarlarda kaprilik, kaprik, laurik, miristik, stearik ve araşidik asitlerin yanısıra, majör doymuş yağ asidi olarak palmitik asit ile başlıca doymamış bileşenler olarak insan sağlığı için anahtar yağ asitleri olan linoleik ve linolenik asitleri içerdiği bulundu.

Anahtar kelimeler: Musa sapientum, Musaceae, muz, sabit yağ, yağ asiti, GC-MS

INTRODUCTION

The genus *Musa* (Musaceae) is one of the interesting tropical plants which have been consumed by humans and animals as a delicious and nutritious food since centuries. *Musa* species have been so far reported to exhibit a number of biological activities such as

antiulcerogenic, antidiabetic, antiatherogenic, antidiarrheic, antitumoral, and antimutagenic (1-7). The fruits are rich in starch, chlorophyls, carotenoids, flavonoids and coumarins (2).

Modern nutritional science is now developing new insights into the relation between food intake and health, and interest in the role of diet. In the search for means to improve human health, fatty acids **have** been promoted as valuable dietary compounds. As the major natural sources of essential fatty acids such as evening primrose oil and borage oil, plant oils contain high amounts of linoleic and y-linolenic acids, which are converted in the body to dihomo-y-linolenic acid and subsequently to arachidonic acid. This may explain the beneficial effect of plant oils rich in n-6 fatty acids in cardiovascular diseases (8). Dietary consumption of some plant and fish oils is also known **to** modulate the balance of lipid inflammatory mediators and, therefore, is valuable in treatment of inflammatory skin disorders (9, 10).

To exemplify the fatty acid containing preparations, Exorex®, originally derived from the fatty acids of banana peels, was developed in South Africa against psoriasis and seborrhetic dermatitis. In 1993, Linotar (sold under the trade name Exorex® in the U.S.A., Canada, U.K., Holland and Austria) was registered with South African Medicines Control Council by Meyer Zall Laboratories (11-13). This preparation consists of three fatty acid derivatives, namely ethyl oleate, ethyl linoleate, and ethyl linolenate. In this study, we have aimed to investigate the fatty acid compositions of the fixed oils of the dried and fresh fruit peels of *M. sapientum* var. *cavendishii* by capillary gas chromatography- mass spectrometry (GC-MS) as to see the differences in the dried and fresh banana peels. There has been so far a few studies on the aromatic content of banana fruits previously (14,15). Conversely, only one report on the fatty acid esters of banana peels has been found to date, species name of the banana used in that study was not indicated (16). Therefore, this is the first report on the fatty acid content of the peels of *M. sapientum* var. *cavendishii.*

MATERIAL AND METHOD

Plant material

Musa sapientum. L. var. *cavendishii* fruits were purchased from an outdoor market in Ankara. A voucher specimen has been kept in the authors' laboratory in the Faculty of Pharmacy, Gazi University, Ankara, Turkey.

General experimental procedures

Chromatographic analysis was carried out with an Hewlett Packard Model 6890/5972 gas chromatograph-mass spectrometry (GC-MS). The capillary column used was an HP-5MS (5 % phenyl methylsiloxane, 0.25 μm film thickness, 30 m x 250 μm, i.d., model no. HP 190915-433). The analytical conditions for GC-MS were set as follows: carrier gas: helium (lmL/min), flow rate: 1 mL/min, detector temperature: 250 °C, column temperature: 250 °C, injector temperature: 250 °C, split ratio: 1/20, split flow: 20 mL/min, average velocity: 36 cm/sec, run time: 30.83 min, pressure: 7.6 psi. Initial temperature was 40 °C for 2 min after injection, then increased to 250 °C (8 °C/min) with a final hold at 250 °C for 10 min. MS operating parameters were: ionization voltage: 70 eV, ion source temperature: 250 °C, mass range *(m/z):* 20-440.

Extraction and methylation of the fatty acids

Musa sapientum L. var. *cavendishii* fruits were peeled off and divided into two portions. The first portion (46.27 g) was air-dried and powdered with anhydrous sodium sulfate. The second portion (130.66 g) was used freshly to obtain the fixed oil. Both of the dried and fresh banana peels were extracted with petroleum ether in a Soxhlet apparatus. Dried and fresh banana peels, which were dark yellow in color, yielded 1.49 g (3.22 %) and 0.98 g (0.75 %) of fixed oils, respectively. The oils were saponified with 0.5 N NaOH solution and free fatty acids were converted to their methyl ester forms with boron trifluoride-methanol complex (20 %, Merck) reagent according to Morrison's method (17). The methyl esters of fatty acids were dissolved in $CHCI_3$ and applied to GC-MS at 0.2 μl of injection volume.

RESULTS AND DISCUSSION

A total of 8 saturated (caprylic, capric, lauric, myristic, palmitic, stearic, arachidic, and behenic acids) and 3 unsaturated fatty acids (palmitoleic, linoleic, and linolenic acids) were identified by relative retention times compared to those of standards using a comprehensive bank of Wiley library. According to our results, fixed oils obtained from the dried and fresh fruit peels of *M. sapientum* var. *cavendishii* have been shown to be particularly rich in linoleic and linolenic acids, which are two key essential unsaturated fatty acids that human body needs, as well as palmitic acid as the main saturated fatty acid (Figure 1 and 2). When compared the fixed oils of fresh and dried banana, some of the saturated fatty acids (caprylic, capric and palmitoleic acids) in fresh banana oil have not been detected in dried banana oil (Table 1).

Besides, percentages of all fatty acids detected in the fresh banana peel oil have been found to be higher than those detected in the dried banana peel oil.

Therefore, we conclude that the fixed oils of the dried and fresh fruit peels of *M. sapientum* var. *cavendishii* have a remarkable nutritious value due to their rich fatty acid contents. Although the banana peels are not edible, they can be evaluated as a new natural source for obtaining essential fatty acids. To the best of our knowledge, this is the first comparative report on fatty acid composition of the fresh and dried peel oils of *M. sapientum* var. *cavendishii*.

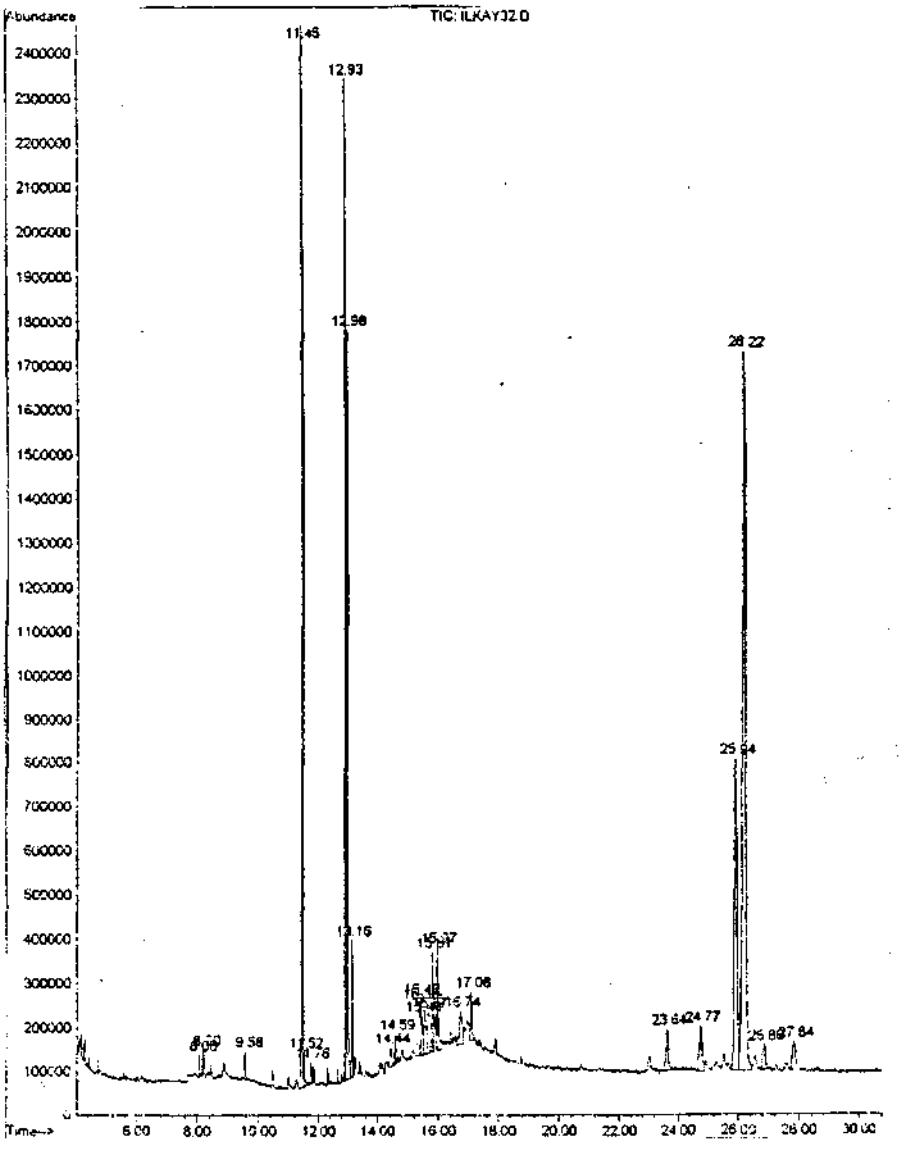

Figure 1. GC-MS chromatogram of the dried banana peel oil.

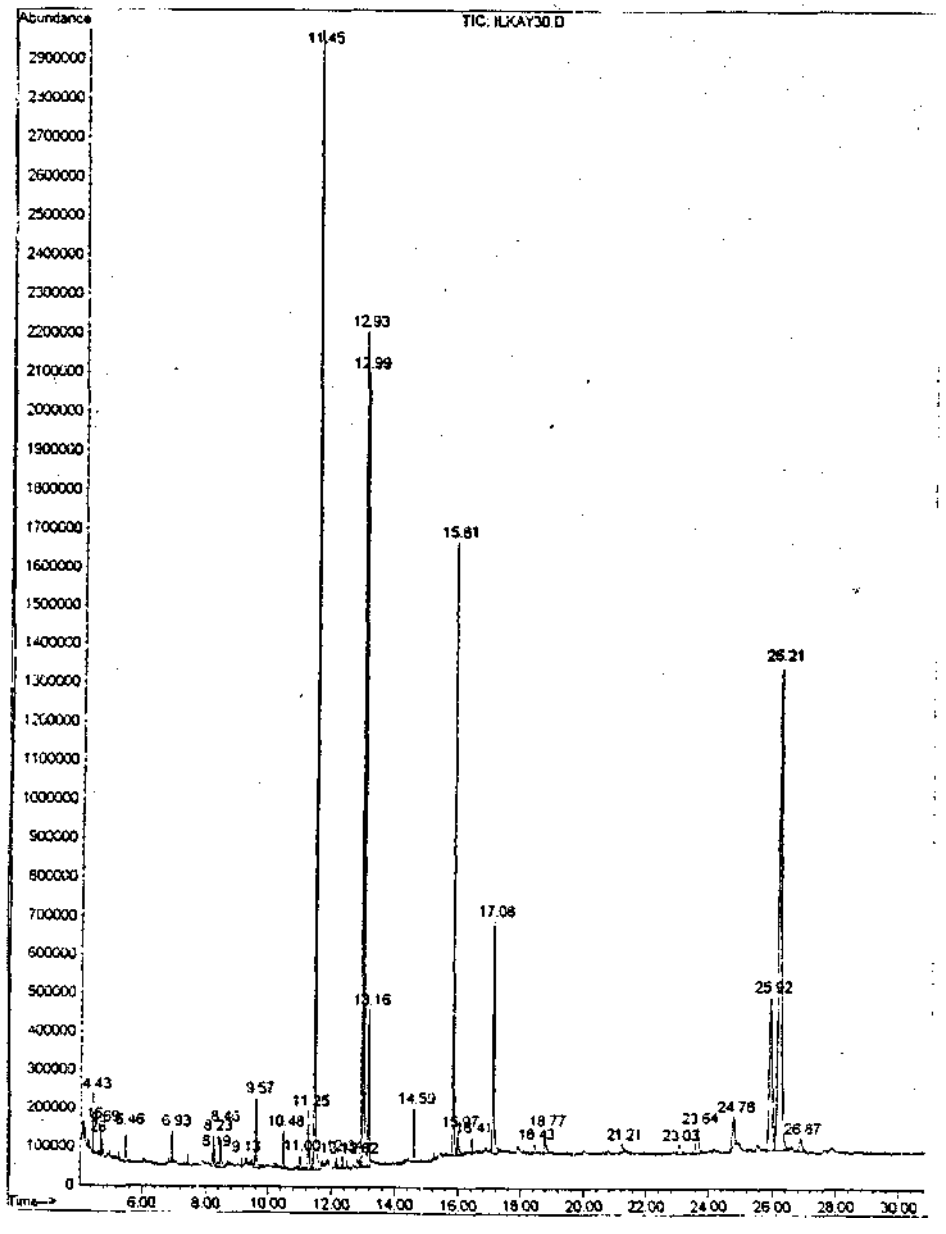

Figure 2. GC-MS chromatogram of the fresh banana peel oil.

Table 1. Fatty acid contents of the oils obtained from the fresh and dried banana peels of *M. sapientum* var. *cavendishii*.

Retention time (min)	Fatty acid detected	Percentage in	
		Fixed oil of fresh banana peels	Fixed oil of dried banana peels
5.46	Caprylic acid	0.404	-
6.93	Capric acid	0.344	-
8.23	Lauric acid	0.511	0.227
9.57	Myristic acid	1.191	0.502
11.25	Palmitoleic acid	1.390	-
11.45	Palmitic acid	14.604	11.636
12.93	Linoleic acid	10.418	9.602
12.99	Linolenic acid	15.093	11.783
13.16	Stearic acid	2.228	1.452
14.59	Arachidic acid	0.840	0.399
15.81	Behenic acid	7.181	1.432

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