IBN AL- HAITHAM J. FOR PURE & APPL. SCI VOL.20 (2) 2007

Fatty Acids Composition of Seed Oils of Some Prunus Genus Fruits in Kurdistan Region

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Abstract

The Fatty acid compositions of the Seed Oil of some prunus genus such as prunus persica (peach), prunus armeniaca (apricot), prunus salicina (plum), and prunus mahleb which are grown in Kurdistan Region-Iraq (Season 2003) were determined.

The percentages of seed oils were found to be 3.7, 4.4, 5.5, 33.5, and 32.8% respectively.

It has been found that the seed oils of all studied fruits contain myristic, palmitic, stearic, oleic, and linoleic acid, while seed oils of prunus armeniaca (apricot) and two varieties of prunus mahleb (Haji &Qaradak) contain (C17) heptadecanoic acid which is the odd number of Carbon and the rare fatty acid in nature.

All seed oils contain high levels of oleic, linoleic, and palmitic acid about 60-67%, 30%, and 10% respectively.

Key Words: GLC, Fatty acid, Heptadecanoic acid (C17), Prunus genus fruits.

Introduction

Prunus genus is a large genus of some 430 species of both ever green and deciduous trees and shrubs with alternate leaves, with stipules at their base,

flower with petals and a one-seeded drupe as the fruit in most of the species the fruit have the stone surrounded by a fleshy larger, all the species flower clarly in the season and the flower are usually either white or pink. Most species appreciate an alkaline soil and require full exposure to the sun. (1)

Prunus persica (peach), prunus armeniaca (apricot), prunus salicina (plum), and prunus mahleb belongs to Rosacea family, this large family of 100 genera and 2000 species includes trees, shrub, and usually perennial herbs.(2)
Kernel oil was also evaluated for edible purposes and also is being used in cosmetics. (3)

In west Asia, mahleb kernels are best known in the cooking styles of Lebanon and Armenia. (4)

Peach kernel, helps promote circulation, dissolves accumulated clots, and act as a laxative for dry intestine, it is said to "loosen the belly" and open stoppages of the liver. It helps to regulate menstruation and can be used for after childrith pain, high highblood pressure, traumatic injuries and chronic appendicitis. It helps expel worns, is good for skin diseases and has sedative effects. (5)

Works on various species of some prunus genus fruits, prunus persica (peach), prunus armeniaca (apricot), prunus salicina (plum), and prunus mahleb has been reported (3,5,6). Meanwhile, literature survey revealed that a very little chemical work has been done on prunus mahleb (mahleb cherry kernel) especially grown in Iraqi Kurdistan region. The aim of this present work is the determination of the percentage of seed oils , and the oils analysis qualitatively and quantitatively for the fatty acid content using G.L.C. gas liquid chromatography in some prunus genus fruits in the Iraqi Kurdistan region.

Material and Methods

Fruit samples of kernels (prunus persica, prunus armeniaca, prunus salicina and two varieties of prunus mahleb were harvested by hand in its optimum state of ripeness for two consecutive (seasons in 2003) in Sulaimani City (Kurdistan region, Iraq), after a morphological and chemical characterization the samples were prepared for determination of oils and fatty acids.

Preparation of the Sample for the Determination of Total Oil Content:-

Samples were taken from each fruits kernel (prunus persica, prunus armeniaca, prunus salicina, prunus mahleb (Haji), and prunus mahleb (Qaradak) to be studied, each sample weighing 10g.

The fruits were dried for 2 days in an air oven at 60C°. They were later grounded through a willy mill and oils were extracted with petroleum ether (40-60C°), using soxhlet apparatus according to AAcc methods. (7)

The oil was recovered by petroleum ether evaporation in a rotary evaporator at a 60C°. The samples were then dried in a desiccator for 1 hour, and finally weighed to obtain the weight of extracted oils.

The extracted oils were dissolved in diethyl ether (10ml.) and kept to be used later for determining the fatty acids composition.

The characteristic properties of the oils of each fruit samples were determined by conventional methods (8), the result were presented in Table (1).

Preparation of the Samples for Determining of Fatty Acids

The fatty acids were determined using methyl esters before GLC analysis, all samples were subjected to a purification process consisting of :-

(I)- Purification of the triglycerides fraction.

(II)- Esterification with alcoholic KOH.

The purification of the triglycerides fraction were carried out by carefully evaporating the sample until they were dried and using a nitrogen current, they were redissolved in diethyl ether: hexane 90:10 in a silica column of 20 × 0.9 cm with diethyl ether: hexane 90:10 tap, the samples are deposited and eluted at one ml /min. with 50 ml of diethyl ether: hexane 90:10. (8)

Trans Esterification:

Esterification with methanolic alcohol was carried out by taking an aliquot from each sample oils, and methylating then by tans esterfication with alcoholic KOH (2N) (1g of oils was put in 20ml stopped test tube then 10ml of heptane was added, also 0.5ml of 2N methanolic KOH was added, the mixture was shaked for 20 sec and the solution became clear, after a while, turbidity forms due to the separation of glycerol, the upper heptane layer containing the methyl esters was decanted into a small vial.) (9)

GLC-Analysis:

After the esterfication the methyl ester compositions are analyzed using GLC, injecting (0.2ML) of organic phase, the mobile phase was nitrogen gas and a glass column which is (6 foot) in length and (4 mm) in diameter was used. The stationary phase was %15 of DEGS (Diethylene glycol succinate) on solid material of chromosorb WAW DMCS which is the 80-100 mesh diameters.

The oven temperature was programmed from 140C°-190C° at 80C°/min. The temperatures of both injection and the detector were 200C°. The nitrogen gas flow was 24ml/min. Identification of peaks were achieved by comparison of the retention times of the fatty acids and their methyl esters of the oils with the retention times of pure fatty acids and their methyl esters analyzed under optimum condition aided in the direct identification of the peaks on the chromatographic record. The data calculated as weight percent fatty acids is given in Table (2), (3), (4), (5), and (6).

Result and Discussion

Kernels Fruits (prunus persica, prunus armeniaca, prunus salicina, prunus mahleb (haji),and prunus mahleb (Qaradak) have oil contents 3.7%, 4.4%, 5.5%, 33.5%, and 32.8% respectively. The oils of each fruit samples were yellow in colour. The characteristics properties of the oils compared well to each other Table (1).

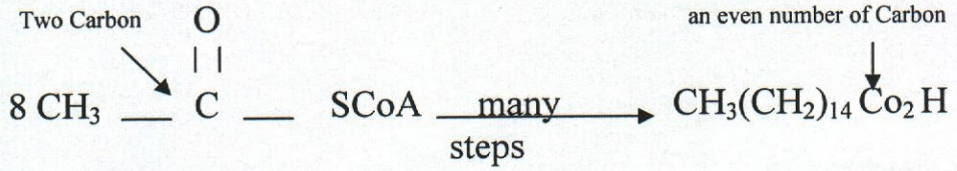
The iodine value is often the most useful figure for identifying oil or at least into a particular group which gives a reasonably quantitative measure of unsaturation of oil (10).

The saponification number represents the amount of saponifable material which is inversely proportional to the mean of the molecular weights of the fatty acids in the glecerides present. (10)

The peroxide value is an indicator of the products of primary oxidation; it measures rancidity or degree of oxidation but not stability of a fat. (11)

A rancid test often begins to be noticeable when the proxide value is between 10 and 20. (10). The fatty acid composition of the seed oils of some prunus genus fruits are presented in Table (2) , (3) ,(4), (5) , (6) .

Almost all naturally occurring fatty acids have an even number of carbon atoms because they are biosynthesized from two-carbon acetyl group in acetyl coenzyme A. (12)



From the result the seed oils of the each fruits contain the high percentage of essential fatty acid linoleic acid. Table (2), (3), (4), (5), (6).

Acknowledgements

We are very much indebted to the Chemistry Department, College of Science, University of Sulaimani for providing the facilities, encouragement and financial support during the investigation. Also endless thanks to the Food Technology Department, College of Agriculture / University of Baghdad to obtain GLC.

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Table (1): Chemical Analysis of the Seed Oils of Prunus Persica (peach), Prunus Armeniaca (apricot), Prunus Salicina (plum), and Two Varieties of Prunus Mahleb Fruits.

No.	Fruits Seed (kernel)	Oil	Saponification Value	Iodine Value	Acid Value	Peroxide Value
1-	Prunus persica (peach) kernel	3.7%	194	123	1.3	0.95
2-	Prunus armeniaca (apricot) kernel	4.4%	192	110	1.25	1.05
3-	Prunus salicina (plum) kernel	5.5%	187	99	1.25	1.1
4-	Prunus mahleb kernel type (haji)	33.515%	193	98	1.21	1.025
5-	Prunus mahleb kernel type (Qaradak)	32.832%	195	98	1.22	1.021

Table (2): Percentage of Fatty Acid Obtained from GLC Analysis of Seed Oil of Prunus Persica (peach) Fruit

No.	No. of Carbon	Common Name of the Acid	Sat or Unsat	Rt time	Area under peak(%A)
1-	C14	Myristic	Sat	1.25	0.66063
2-	C16	Palmitic	Sat	2.12	8.393
3-	C16¯	Palmitoleic	Unsat	2.50	1.342
4-	C18	Stearic	Sat	3.70	1.305
5-	C18¯	Oleic	Unsat	4.31	62.17
6-	C18=	Linoleic	Unsat	5.32	26.64

Table (3): Percentage of Fatty Acid Obtained from GLC Analysis of Seed Oil of Prunus Armeniaca (apricot) Fruit

No.	No. of Carbon	Common Name of the Acid	Sat or Unsat	Rt time	Area under peak(%A)
1-	C14	Myristic	Sat	1.23	0.03818
2-	C16	Palmitic	Sat	2.11	8.443
3-	C17	Heptadecanoic	Sat	3.25	0.08274
4-	C18	Stearic	Sat	3.71	1.205
5-	C18¯	Oleic	Unsat	4.40	59.77
6-	C18=	Linoleic	Unsat	5.38	30.22
7-	C18=	Linolenic	Unsat	8.48	0.1278

Table (4): Percentage of Fatty Acid Obtained from GLC Analysis of Seed Oil of Prunus Salicina (plum) Fruit

No.	No. of Carbon	Common Name of the Acid	Sat or Unsat	Rt time	Area under peak(%A)
1-	C14	Myristic	Sat	1.26	0.04665
2-	C16	Palmitic	Sat	2.13	7.125
3-	C16¯	Palmitoleic	Unsat	2.52	1.375
4-	C18	Stearic	Sat	3.72	1.558
5-	C18¯	Oleic	Unsat	4.35	65.86
6-	C18=	Linoleic	Unsat	5.34	23.89

Table (5): Percentage of Fatty Acid Obtained from GLC Analysis of Seed Oil of Prunus Mahleb (Haji) Fruit

No.	No. of Carbon	Common Name of the Acid	Sat or Unsat	Rt time	Area under peak(%A)
1-	C14	Myristic	Sat	1.23	0.03533
2-	C16	Palmitic	Sat	2.11	5.632
3-	C16¯	Palmitoleic	Unsat	2.52	1.124
4-	C17	Heptadecanoic	Sat	3.28	0.0908
5-	C18	Stearic	Sat	3.73	1.215
6-	C18¯	Oleic	Unsat	4.37	65.79
7-	C18=	Linoleic	Unsat	5.35	26.03

Table (6):- Percentage of Fatty Acid Obtained from GLC Analysis of Seed Oil of Mahleb (Qaradak) Fruit

No.	No. of Carbon	Common Name of the Acid	Sat or Unsat	Rt time	Area under peak(%A)
1-	C14	Myristic	Sat	1.23	0.04904
2-	C16	Palmitic	Sat	2.12	9.484
3-	C16¯	Palmitoleic	Unsat	2.48	0.9629
4-	C17	Heptadecanoic	Sat	3.23	0.06601
5-	C18	Stearic	Sat	3.69	1.941
6-	C18¯	Oleic	Unsat	4.34	67.92
7-	C18=	Linoleic	Unsat	5.29	19.35
8-	C18=	Linolenic	Unsat	8.48	0.1053

مجلة ابن الهيثم للعلوم الصرفة والتطبيقية المجلد20 (2) 2007

تركيب الحوامض الدهنية لزيوت Prunusفي أقليم كردستان نواة بعض ثمرة جنس

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الخلاصة

الغرض الاساسي لهذا البحث هو تحديد نسبة الزيوت تركيب الاحماض الدهنية بوساطة جهاز GLC(كروما توغرافيا سائل – غاز) لنواة بعض ثمرة جنسPrunus مثل Prunus Persica (خوخ)Prunus armenica (مشمس) Prunus salisina (عنجاص) ونوعين من Prunus mahleb (محلب) وكانت نسب الزيوت التى تم الحصول عليها نحو الأتى :
3.7% و 4.4 % و 5.5% و 33.5% و 32.8% باستخدام المذيب العضوي (ايثر بترولي) petroleum ether b.p.30-40 c وجهاز soxhlet . وقد تم تحليل الزيوت نواة لكل فاكهة كمياً ونوعياً باستخدام جهاز GLC
(كروماتوغرافيا سائل–غاز) بعد تحويل هذة الاحماض الى الاسترات المقابلة و النتائج على وجود الآحماض الدهنية غير المشبعة وبشكل عام تحتوي على الآحماض الدهنية الاتية : مايرستيك، بالمتيك، ستيريك ،اوليك ،لينوليك ولكن زيوت نواة ثمرة المشمسنوع ارمينيمانكا ونوعين من محلب (Haji & Qaradak) يحتويان على حامض دهني Heptadecanoic acid C17 وهو حامض دهني نادر في الطبيعة وعدد الكاربون فردياندزيوت نواة كل فاكهة تحتوي على نسبة عالية من حامض اوليك – لينوليك وبالمتيك أسيد بحدود 60 – 67% ، 30% ، 10%.