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Research Article

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Effect of Ripening Time of Fruits in the Chemical Composition (%) of Fatty Acids in Syrian Laurel Oil

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Abstract

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of fatty acids in laurel oil extracted from the fruits (green, brown and black) by hexane using gas chromatographic analysis after converting fatty acids to methyl esters (FAMEs) was studied. It was found that the ratios of fatty acids change with the time of growth and with the maturation of the fruits. The proportion of lauric acid was decreasing with the time of growth (37.596% to 22.301% from October to December) and with the transformation of fruits from green to black (37.596% to 27.641% in October, 33.614% to 25.860% in November and 27.719% to 22.301% in December).The proportion of unsaturated fatty acids (USFA) increases, while the proportion of saturated fatty acids (SFA) decreases with the transition of the oil extracted from the green fruits to the oil extracted from the black fruits as well as with the ripening time.

Keywords: Laurel oil, Fatty acids, (SFA), (USFA), Gas chromatographic analysis.

Introduction

The laurel plant is widely spread in the Syrian coast, especially in the Kassab. They have an aromatic smell. Laurel trees usually bloom in the spring and yield in the autumn, and the fruits of the laurel resemble olive fruits and their color is black. It contains 25-40% laurel oil and extracts oil by conventional methods [1]. The laurel oil is extracted by the farmers by boiling the laurel fruits with the water. The oil floats and then cools until it freezes and then collects. Laurel oil also known as Mediterranean bay laurel, is widely grown in Turkey, Greece, Italy, Spain, Portugal, France, Syria, Morocco, Algeria, Mediterranean Islands, and California [1-9].

The laurel oil is extracted from the crashed laurel fruits by boiling it with water [1].

The laurel oil is composed of the rest of the vegetable oils from glycerides of laurel and other fatty acids, such as palmitic, oleic and linoleic acid. Lauric acid is found only in the bay laurel berry kernel. The oil obtained from laurel berry is used in soap making, medicine, and cosmetics industry. In recent years, parallel to the demand for natural products the demand for bay laurel soap is increasing day by day, and bay laurel berries are used as a natural anthocyanin instead of synthetic dyes in the food, pharmaceutical, and cosmetic industries [10-11].The laurel oil extracted from fruits are used in the following industries: Laurel soap of all kinds, Laurel shampoo of all kinds and liquid laurel soap [1].

Determination of some fatty acids in laurel oil extractive from wild fruits and cultivated *Laurus nobilis* after converting fatty acids to methyl esters (FAMEs) using gas chromatographic analysis with capillary column (OPTIMA-FFAP- 0.25 µm, 60 m × 0.32mm ID) and FID detector was studied. This study showed that the components of oil is clearly influenced by the environment in which the laurel trees grow as the following :laurel oil extractive from the fruits of wild laurel trees of the mountains from (Alkanaif, Salhab, Hama, Syria): lauric acid 33.736 %, palmitic acid 10.669 %, oleic acid 21.841 %, linoleic acid 22.870 % (total of these four fatty acids 89.116 %), laurel oil extractive from the fruits of wild laurel trees of the plains from (Daret-Ezah, Aleppo, Syria): lauric acid 26.525 %, palmitic acid 11.166 %, oleic acid 29.151 %, linoleic acid 23.094 % (total of these four fatty acids 89.936 %) and laurel oil extractive from the fruits of cultivated laurel trees from (Nahr Al-Bared, Salhab, Hama, Syria): lauric acid 12.100 %, palmitic acid 19.329 %, oleic acid 33.062 %, linoleic acid 20.355 %, palmitoleic acid 12.062 % (total of these five fatty acids 96.908 %). It was found that, the laurel oil extracted from the fruits of wild laurel trees of the mountains was contained of lauric acid 2.79 times more than laurel oil extracted from the fruits of cultivated laurel trees and 1.27 times more than laurel oil extracted from the fruits of wild laurel trees of the plains [1].

Materials and Methods

Instruments and apparatus

A Shimadzu GC-2010 gas chromatograph with capillary column (TRB-WAX 0.5 µm, 30 m ×0.32 mm, Serial: N2068586), auto injecter-AOC-20i and FID detector were used. For microwave digestion of the samples, a high performance microwave digestion apparatus MLS-1200 MEGA with EM-30 unit (Milestone GmbH) was used. An ultrasonic processor model Powersonic 405 was used to sonicine the sample solutions. The diluter pipette model DIP-1 (Shimadzu), having 100 µL sample syringe and five continuously adjustable pipettes covering a volume range from 10 to 5000 µL (model Piptman P, GILSON). Centrifuge (Centurion Scientific Ltd., Model: K2080-Manufactured in the United Kingdom) was used for the preparation of the experimental solutions. SARTORIUS TE64 electronic balance was used for weighing the samples.

Reagents

Hexane (extra pure) was purchased from Merck. Standard of fatty acids (FAME 16 Mix, Cat. No. 722320) was purchased from MACHEREY-NAGEL GmbH& Co. KG, Neumann-Neander-Str. 6-8, D-52355 Duren, Germany.

Samples preparation

The fruits of the laurel were collected from the Kassab area in Syria. Dry the fruits in room temperature. Then crushed by an electric mixer and kept in polyethylene packages for next procedures in a temperature of 10°C. Extract the oil with hexane by the distillation until the extraction is completed. Then extract the oil from the hexane and collect in a glass container. The amount of laurel oil in the dried and crushed laurel fruits was different with the maturity of the fruits (green, brown and black) and the different ripening times (in October, November and December) in the green, brown and black fruits as follows: 24%, 26% 30% (in October 10.2018), 26%, 29%, 34% (in November 10.2018), and 29%, 35% and 39% (in December 10.2018).

Results and Discussion

Analytical procedure

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December in the chemical composition of fatty acids in laurel oil extracted from the fruits (green, brown and black) by hexane using gas chromatographic analysis after converting fatty acids to methyl esters (FAMEs) was studied. Programmed column temperature 80°C for 5 min and then increase it to 230^0C with increasing temperature rate 10^0C/min, FID, flow rate of N_2 carrier gas 1.7 mL.min^{-1}, the injection volume 1 µL with split injection mode 1:10, injected port temperature 250^0C, and temperature of FID 250^0C.

Effect of ripening time in the chemical composition of fatty acids in laurel oil

In October 10. 2018

The components of laurel oil using gas chromatography with a detector FID for oil extracted from the green, brown and black fruits were identified. It was found that the main components of fatty acids in laurel oil for the three samples areas follows:37.596% to 27.641%, 10.826% to 13.921%, 21.824% to 29.410%, 21.888% to 21.840% and 4.433% to 4.212% of lauric acid, palmitic acid, oleic acid, linoleic acid and butyric acid, respectively (total of these five fatty acids96.567% to 97.024%), see Figure 1-3 (as examples) and Table 1-3.

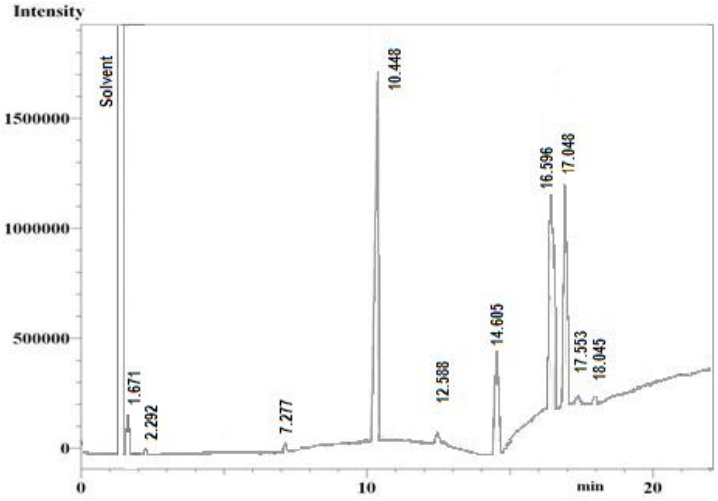

Fig.1. Gas chromatographic analysis of laurel oil extracted from green fruits in October 10.2018 (Programmed column temperature 80°C for 5 min and then increase it to 230°C with increasing temperature rate 10°C/min, FID, flow rate of N_2 carrier gas 1.7 mL.min^{-1}, the injection volume 1 µL with split injection mode 1:10, injected port temperature 250°C and temperature of FID 250°C).

Table 1. The components of laurel oil extracted from the green fruits in October 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.671	1570898	4.433
Caprilic Acid, **C8**	2.292	1063	0.003
Capric Acid, **C10**	7.277	170095	0.480
Lauric Acid, **C12**	10.448	13322690	37.596
Myristic Acid, **C14**	12.588	523042	1.476
Palmitic Acid, **C16**	14.605	3836351	10.826
Oleic Acid, **C18:1**	16.596	7733652	21.824
Linoleic Acid, **C18:2**	17.048	7756331	21.888
Arachidonic Acid, **C20**	17.553	289516	0.817
Linolenic Acid, **C18:3**	18.045	199862	0.564
Total		**35403500**	**99.907**
Saturated fatty acids, **SFA**	55.631%		
Unsaturated fatty acids,**USFA**	44.276%		

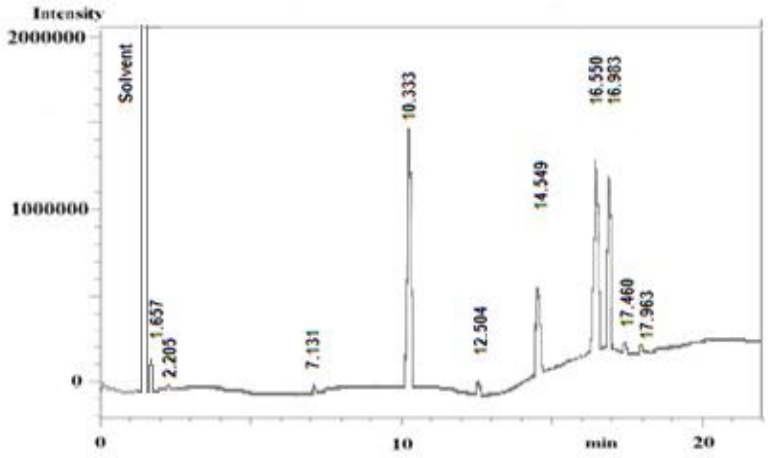

Fig. 2. Gas chromatographic analysis of laurel oil extracted from brown fruits in October 10.2018 (Programmed column temperature 80°C for 5 min and then increase it to 230°C with increasing temperature rate 10°C/min, FID, flow rate of N_2 carrier gas 1.7 mL.min^{-1}, the injection volume 1 µL with split injection mode 1:10, injected port temperature 250°C, and temperature of FID 250°C).

Table 2. The components of laurel oil extracted from the brown fruits in October 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.657	1505858	4.310
Caprilic Acid, **C8**	2.205	4193	0.012
Capric Acid, **C10**	7.131	122286	0.350
Lauric Acid, **C12**	10.333	11502172	32.921
Myristic Acid, **C14**	12.504	448613	1.284
Palmitic Acid, **C16**	14.549	4514081	12.920
Oleic Acid, **C18:1**	16.550	8573959	24.540
Linoleic Acid, **C18:2**	16.983	7637602	21.860
Arachidonic Acid, **C20**	17.460	292088	0.836
Linolenic Acid, **C18:3**	17.963	175392	0.502
Total		**34776244**	**99.535**
Saturated fatty acids, **SFA**	52.633%		
Unsaturated fatty acids, **USFA**	46.902%		

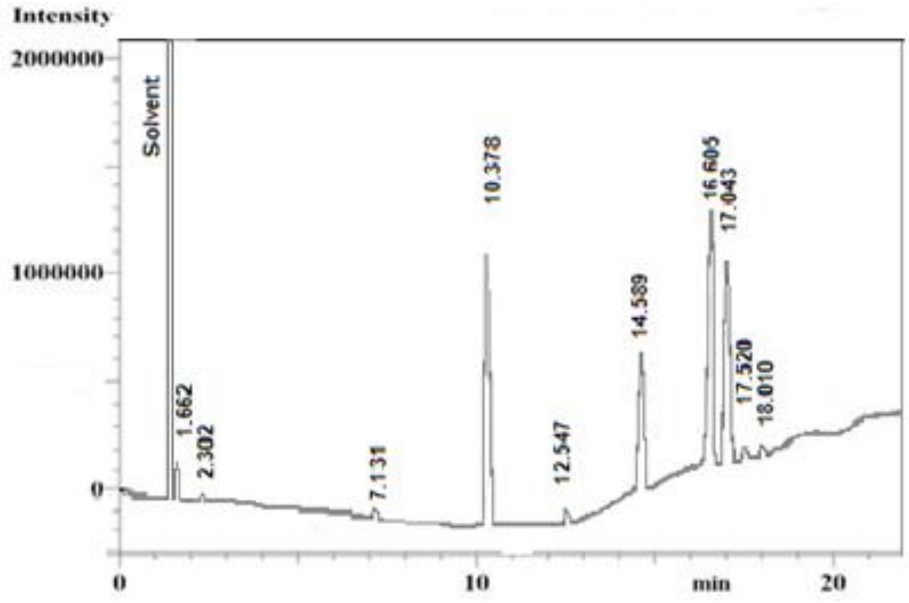

Fig. 3. Gas chromatographic analysis of laurel oil extracted from black fruits in October 10.2018 (Programmed column temperature 80°C for 5 min and then increase it to 230°C with increasing temperature rate 10°C/min, FID, flow rate of N_2 carrier gas 1.7 mL.min^{-1}, the injection volume 1 µL with split injection mode 1:10, injected port temperature 250°C, and temperature of FID 250°C).

Table 3. The components of laurel oil extracted from the black fruits in October 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v %
Butyric Acid, **C4**	1.662	1500199	4.212
Caprilic Acid, **C8**	2.302	6411	0.018
Capric Acid, **C10**	7.131	121099	0.340
Lauric Acid, **C12**	10.378	9844968	27.641
Myristic Acid, **C14**	12.547	383954	1.078
Palmitic Acid, **C16**	14.589	4958279	13.921
Oleic Acid, **C18:1**	16.605	10475038	29.410
Linoleic Acid, **C18:2**	17.043	7778811	21.840
Arachidonic Acid, **C20**	17.520	301678	0.847
Linolenic Acid, **C18:3**	18.010	177018	0.497
Total		**35547655**	**99.804**
Saturated fatty acids, **SFA**	51.747%		
Unsaturated fatty acids, **USFA**	48.057%		

In November 10.2018

The components of laurel oil collected in November 10 (green, brown and black) were selected. It found that the proportion of lauric acid decreased in all samples compared with the samples collected in 10 October, and the ratio of oleic acid increased, while only minor changes were obtained on other components, see tables 4-6.

Table 4. The components of laurel oil extracted from the green fruits in November 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.681	2037674	5.910
Caprilic Acid, **C8**	2.235	4137	0.012
Capric Acid, **C10**	7.287	165496	0.480
Lauric Acid, **C12**	10.468	11589573	33.614
Myristic Acid, **C14**	12.588	410293	1.190
Palmitic Acid, **C16**	14.625	4013287	11.640
Oleic Acid, **C18:1**	16.606	8088635	23.460
Linoleic Acid, **C18:2**	17.068	7578355	21.980
Arachidonic Acid, **C20**	17.573	282723	0.820
Linolenic Acid, **C18:3**	18.065	221351	0.642
Total		**34391524**	**99.748**
Saturated fatty acids, **SFA**		53.666%	
Unsaturatedfatty acids, **USFA**		46.082%	

Table 5. The components of laurel oil extracted from the brown fruits in November 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.677	2001920	5.680
Caprilic Acid, **C8**	2.215	6344	0.018
Capric Acid, **C10**	7.151	110669	0.314
Lauric Acid, **C12**	10.353	10862885	30.821
Myristic Acid, **C14**	12.524	304517	0.864
Palmitic Acid, **C16**	14.569	4595957	13.040
Oleic Acid, **C18:1**	16.570	8885283	25.210
Linoleic Acid, **C18:2**	16.993	7713737	21.886
Arachidonic Acid, **C20**	17.470	296763	0.842
Linolenic Acid, **C18:3**	17.983	222045	0.630
Total		**35000120**	**99.305**
Saturated fatty acids, **SFA**		51.579%	
Unsaturated fatty acids, **USFA**		47.726%	

Table 6. The components of laurel oil extracted from the black fruits in November 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.682	1923315	5.410
Caprilic Acid, **C8**	2.338	9243	0.026
Capric Acid, **C10**	7.267	86389	0.243
Lauric Acid, **C12**	10.388	9193519	25.860
Myristic Acid, **C14**	12.567	233215	0.656
Palmitic Acid, **C16**	14.599	4980712	14.010
Oleic Acid, **C18:1**	16.635	10680622	30.043
Linoleic Acid, **C18:2**	17.063	7815202	21.983
Arachidonic Acid, **C20**	17.540	308228	0.867
Linolenic Acid, **C18:3**	18.030	210818	0.593
Total		**35441263**	**99.691**
Saturated fatty acids, **SFA**		47.072%	
Unsaturated fatty acids, **USFA**		52.619%	

In December 10.2018

The proportions of the components of laurel oil from fatty acids in the samples collected in December 10.2018 of the three species (green, brown and black) using chromatographic analysis was identified. It was found that the ratio of lauric acid continued to decrease and the percentage of oleic acid continued to increase, while other fatty acids were not significantly affected, see Tables 7-9.

Table 7. The components of laurel oil extracted from the green fruits in December 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.691	2629973	7.573
Caprilic Acid, **C8**	2.255	5209	0.015
Capric Acid, **C10**	7.297	168432	0.485
Lauric Acid, **C12**	10.488	9626335	27.719
Myristic Acid, **C14**	12.598	320889	0.924
Palmitic Acid, **C16**	14.645	4370556	12.585
Oleic Acid, **C18:1**	16.616	9277316	26.714
Linoleic Acid, **C18:2**	17.078	7671480	22.090
Arachidonic Acid, **C20**	17.583	287550	0.828
Linolenic Acid, **C18:3**	18.085	246571	0.710
Total		**34604311**	**99.643**
Saturated fatty acids, **SFA**		53.129%	
Unsaturated fatty acids, **USFA**		46.514%	

Table 8. The components of laurel oil extracted from the brown fruits in December 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.697	2235713	6.450
Caprilic Acid, **C8**	2.225	9210	0.026
Capric Acid, **C10**	7.171	120971	0.349
Lauric Acid, **C12**	10.373	8886004	25.636
Myristic Acid, **C14**	12.554	252574	0.713
Palmitic Acid, **C16**	14.589	5743875	14.511
Oleic Acid, **C18:1**	16.590	9746320	28.118
Linoleic Acid, **C18:2**	16.993	7905064	22.006
Arachidonic Acid, **C20**	17.480	316119	0.912
Linolenic Acid, **C18:3**	17.993	213866	0.617
Total		**35429716**	**99.338**
Saturated fatty acids,**SFA**		48.597%	
Unsaturated fatty acids, **USFA**		50.741%	

Table 9. The components of laurel oil extracted from the black fruits in December 10.2018 using gas chromatographic analysis with a detector FID.

Name	Ret.Time, min	Area	Concentrations, v%
Butyric Acid, **C4**	1.692	2217790	6.340
Caprilic Acid, **C8**	2.358	11194	0.032
Capric Acid, **C10**	7.287	57369	0.164
Lauric Acid, **C12**	10.398	8500712	22.301
Myristic Acid, **C14**	12.587	192045	0.549
Palmitic Acid, **C16**	14.609	5147092	14.714
Oleic Acid, **C18:1**	16.655	10558989	32.185
Linoleic Acid, **C18:2**	17.083	7692653	21.991
Arachidonic Acid, **C20**	17.560	272851	0.780
Linolenic Acid, **C18:3**	18.050	192395	0.550
Total		**34843090**	**99.606**
Saturated fatty acids, **SFA**		46.880%	
Unsaturatedfatty acids, **SFA**		52.726%	

The proportion of lauric acid (in October 10.2018) is greater in the fruits of green about 1.36 times higher than its percentage in oil extracted from black fruits; the oil extracted from the fruits of green better in terms of the proportion of laurel oil extracted from other fruits, see Figure 4. As for the lauric acid (in November 10. 2018), in the green fruits is approximately 1.30 times higher than its percentage in oil extracted from black fruits, see Figure 5. While the proportion of lauric acid in green fruits (in December 10.2018) was about 1.24 times higher than the oil extracted from black fruits, see Figure 6. The percentage of oil extracted from black fruits is greater than of oil extracted from green fruits by about 1.25, 1.31 and 1.34 times is greater than of oil extracted from green fruits in October 10.2018, November 10.2018 and December 10.2018, respectively.

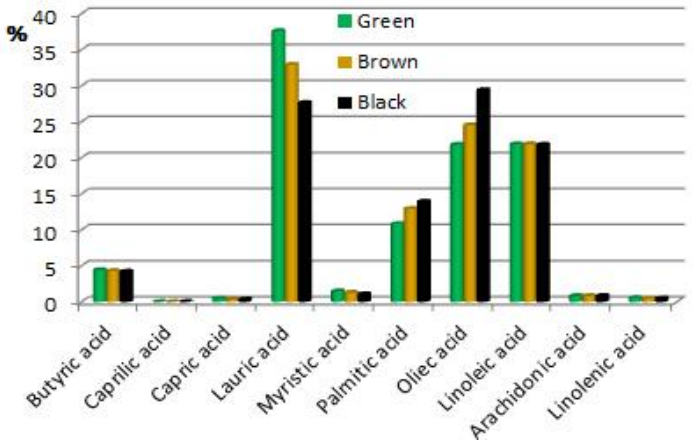

Fig. 4. The percentage of fatty acids in laurel oil extracted from the fruits (green, brown and black) collected in October 10.2018.

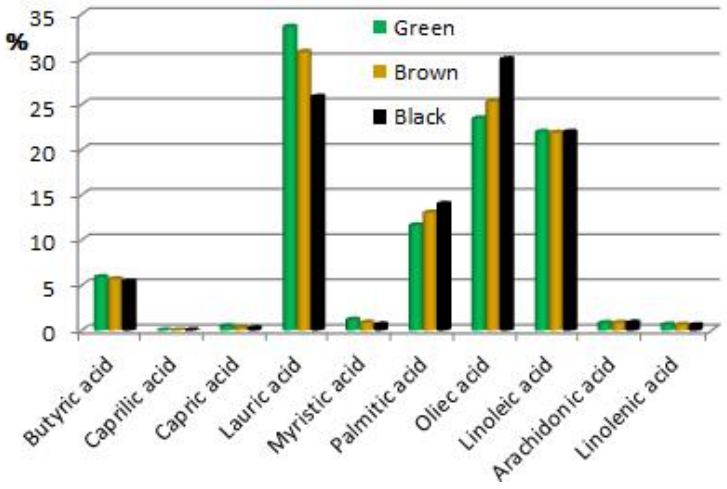

Fig. 5. The percentage of fatty acids in laurel oil extracted from the fruits (green, brown and black) collected in November 10.2018.

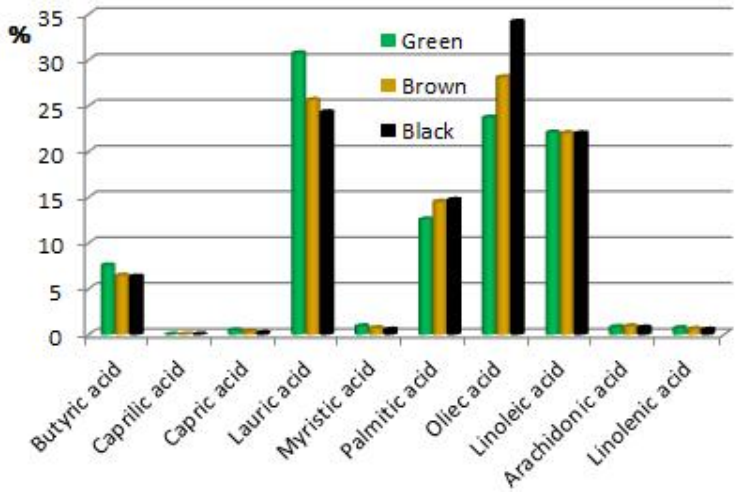

Fig. 6. The percentage of fatty acids in laurel oil extracted from the fruits (green, brown and black) collected in December 10.2018.

Conclusion

The effect of ripening time of the laurel fruits (from the region of Kassab in Syria) between October to December on the chemical composition of fatty acids in laurel oil extracted from the fruits (green, brown and black) was studied. The ratios of fatty acids change with the time of growth and with the maturation of the fruits. The proportion of lauric acid was decreasing with the time of growth (37.596% to 22.301% from October to December) and with the transformation of fruits from green to black (37.596% to 27.641% in October, 33.614% to 25.860% in November and 27.719% to 22.301% in December).The proportion of unsaturated fatty acids (USFA) increases, while the proportion of saturated fatty acids (SFA) decreases with the transition of the oil extracted from the green fruits to the oil extracted from black fruits as well as with the ripening time.

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