African Journal of Biotechnology Vol. 10(41), pp. 8070-8073, 3 August, 2011
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB11.951
ISSN 1684–5315 © 2011 Academic Journals

Full Length Research Paper

Determination of fatty acid composition in seed oils of some important berry species and genotypes grown in Tokat Province of Turkey

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Accepted 29 June, 2011

This study was conducted to determine fatty acid composition in seed oils of four rose hips genotypes (*Rosa canina* L.), one *Rosa montana* L., one elderberry (*Sambucus nigra* L.) and guelder rose genotypes (*Wiburnum opulus* L.) growing in Tokat ecological conditions. As such, fatty acid contents were determined by GC. According to the findings, the amount and kinds of fatty acid contents in all fruit varieties and genotypes showed significant differences. It was determined that oleic acid and linoleic acid levels of all genotypes varied from 5,784 to 51,740% and 6,228 to 43,210%, respectively. In addition, it was determined by the findings of this study that palmitic acid and docosaheksaenoic acid (DHA) of these genotypes were similarly found as 1.183 to 7.702%, but no linolenic acid (ω-3) was found in some genotypes. Thus, linoleic acid level of Ar-11 genotype was higher (43.210%) than the others.

Key words: *Rosa canina*, *Rosa montana,* elderberry, guelder rose, fatty acid composition.

INTRODUCTION

Turkey is a significant gene source for horticultural crops with varieties multiplied numerously during the centuries (Simsek, 2009). In addition, Anatolia has a rich flora because it is found in the intersection points of different plant geographies. The fruits constitute a important department in this rich flora (Nilson, 1997; Turkben et al., 2010). In fruits, berries also grow naturally in almost every region of Turkey. The berries are an important fruit group believed to be consumed in different ways by the people. These fruits have been widely used in the fields of nutrition and health because they contain nutrients and phyto-chemicals. The fruits have increased their importance more with the emergence of their contents. The berries have become the most widely used products in medical, pharmaceutical and cosmetic industry, particularly in the food industry recently (Medve, 1990; Jager et al., 2007; Blamey and Grey-Wilson, 1989). Berries are remarkable with respect to minerals, fruit acids, aromatic substances, karotenoids, flavonoids, seed oils, fatty acids and especially antioxidant substances in high ratio of their contents (Arslan, 2006; Elmastas and Gercekcioglu, 2006). As a result of these cotents, berries were used for antimicrobial, anticancerogenic, antikansorejen, anti-oxidant and antidiabetic purpose on human health (Gercekcioglu et al., 2009; Kara and Gercekcioglu, 1992). The majority of these products which are not rich in vegetable oils and with fatty acid in the composition of these oils are of a special importance (Nilsson, 1997). For example, the total oil contents of *Rose villosa* and *Rose dumalis subsp. Bois-sier* fruits changed between 1.52 and 1.85%, respectively depending on the season (Ercisli, 2007). Oil contents in the seeds of Rose hip unlike some rose species ranged from 4.79 to 5.37%, respectively (Ercisli et al., 2007). As it is known, fatty acids are primary nutritional components found in seed oils (Gercekcioglu et al., 2007). Recent findings indicate that the small and insignificant berry seed may well prove as treasure chests of valuable, health supporting nutritients as well as cosmetically benefical phytochhemicals. Scientists suspect that berry seeds contain high levels ol life prolonging essential fatty acids (EFA), known to be effective against heart diseases, diabetes and cancers. The essential fatty acids such

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as omega 3 fatty acids are found in berry seeds, walnuts, hazelnuts, fish flax seeds and borage (Beyhan et al 1996; Pourrat and Carnat, 1981). In berries, *Rosa canina*, *Rosa montana, Sambucus nigra* and *Viburnum opulus* have an important place. These species are commonly used in the field of nutrition and health in Turkey. These berries play a major role in human nutrition and health, because of its special composition of fat in seed oil, most of which are highly rich in un-saturated fatty acids, proteins, carbohydrate, dietary fiber, vitamin A, B, C, minerals, phytosterals, antioxidants, phenolics and other phytochemicals (Johansson and Kallio, 1997). Varieties, location, composition of soils, usage of fertilizer and surigation affect the fatty acid, mineral and vitamin composition of berries and consequently influence the stability and quality of the product. Some studies have been made on the composition of fatty acids which have importance with respect to human health, but very few studies have been found about the seed oils of our working fruit species. In variety selection studies, the change in the composition of fatty acids is absolutely necessary to put forward the exchange of the composition of fatty acids by taking into account the purposes of using products according to varieties.

This study was conducted to determine the fatty acid compositions in seeds of some important berries which have standard variety candidates in adaptation studies made about some varieties selected from berry species naturally grown in Research and Practice Orchard of Gaziosmanpasa University in Tokat region.

MATERIALS AND METHODS

This study was conducted at the experimental orchard of Horticultural Department, Faculty of Agriculture, Gaziosmanpaşa Üniversity, Tokat, Turkey (4013-4022 N, 361-364 E, Altitude 525 m). Tokat province has a annual average temperature of 12.45C, mean relative humidity of 60.00%, while average rainfall was 454.70 mm (Anonymous, 2009). In the research, one Elderberry (*Sambucus nigra* L.), one Guelder rose (*Viburnum opulus* L.) and one Rosa montana L. were used. Rosa montana L. was the most widely grown with commercial importance in the region and was preferred as a medicinal plant by the local people. However, adaptation to 4 Rose hips (*Rosa canina* L.) genotypes (YL06, YL07, YL08 and Ar11) was done by selection from Tokat region. These genotypes are naturally grown and they are the most commonly used in the region. Therefore, these genotypes were selected because they were plants grown in homogeneous conditions in adaptation orchard. Fruit samples were harvested in the same ripening stage. After fruits were chosen with respect to shape and color uniformity, their seeds were taken and dried (Kara and Gercekcioglu, 1992; Ercişli, 2007; Gercekcioglu et al., 2009).

Extraction of seed oil

The seeds of ripe fruits, removed from trees during the harvest, were dried in shade. Each extraction procedure was carried out in three replications, after which 10 g of crushed seeds was added to 20 ml hexan and the extraction was carried out for 16 h in a temperature of 55°C. The seed oils obtained were used for the analysis of fatty acids. Analysis of fatty acid was performed by GC-FID (Hofstetter et al., 1965).

Analyses of oil components

In the seed samples of these genotypes, oil components were extracted by methanol cloroform solvent using a Soxhlet apparatus. The solvent was removed by rotary evaporation and the oil content was determined as the difference in weight of dried seed sample before and after the extraction (Anonymous, 1989). Consequently, these oils were saponified (IUPAC)(Anonymous, 1988). The seed samples were analysed in triplicate by using the usual procedure. Of the seed oil, 0.4 g was dissolved in 4 ml isooctane and then 2 M methanolic KOH and 0.2 ml was added. It was shaken for 30 s and left in the dark for 6 min, after which 1 to 2 drops of methly orange and 0.45 ml of 0.1 N HCL were added to this mixture. Then, 1.0 µl from upper clear phase containing methly esters of fatty acids was injected to gas chromatography. The working conditions of gas chromatography were equipped with flame-ionization detector and a 60-m capillary column (ID=0.25.mm) was coated with 0.25 µm of 50% cyanopropyl methylpolysiloxane (J&W Scientific, Folsom, CA, USA). Helium was a carrier gas with a flow rate of 1.5 ml/min and a split ratio of 1:20. The injector temperature was 250°C and the detector temperature was 260°C. The oven temperature was programmed at 120°C and was held for 5 min, after which it increased to 250°C with a rate of 10°C/min and the final temperature was held for 20 min. The FAMEs were identified by comparison of their retention times and equivalent chain lenghts by regarding standard FAMEs (Supelco 47885-U). In the seed samples, FAMEs were quantified based on their percentage areas (Anonymous, 1990; Ercisli et al., 2007; Ercişli, 2007; Ozcan, 2002).

RESULTS AND DISCUSSION

Data about fatty acid composition in the seeds of five rose hips and other species are given in Table 1 and Figure 1. It was observed that no lauric acid (C12:0), myristoloeic acid (C14:1), pentadecanoic acid (C15:0), Cis-10 pentadecenoic acid (C15:1), eicosatrienoic acid (C20:3n3), lignoceric acid (C24:0) dicosadienoic acid (C22:2), arachidonic acid (C20:4n6) from ω-6 fatty acids and EPA (Eicosapentaenoic acid) (C:205n3) from ω3 fatty acids was found in the entire samples. Tricosanoic acid (C23:0) was found only as 0.359% in seedless rose hip genotype, while G- linolenic acid (C18:3n6) was found as 0.131% in elderberry seed, but it was not seen in other samples. Tridecanoic acid (C13:0) was determined only as 0.315% in YL 08 of rose hip genotype, while oleic acid (C18:1n9c) from unsaturated fatty acids ranged from 5.784 to 51.740% in the entire seed samples. Oleic acid content was found as the highest level with 51.740% value in Guelder rose seed samples, while the lowest level of oleic acid was found as 5.784% in seedless Rose hip and YL 08 Rose hip (Table 1 and Figure 1). Linolenic acid (C18:3n3) ranged from 0.168 to 0.393%, except YL-07, YL-08 and seedless rose hip genotypes. Linoleic acid and the main fatty acid for all genotypes acid was found between 6.228 (seedless rose hip genotype) and 43.210% (AR 11 rose hip genotype). In addition, it was determined that elderberry genotype in this genotype had

Table 1. Fatty acid composition in seeds of some ımportant berry species and genotypes.

Fatty acid type (%)	*Viburnum opulus*	*Sambucus nigra*	*Rosa montana*	***Rosa canina* genotypes**			
				YL06	**YL07**	**YL08**	**Ar11**
Caproic acid (6:0)	0.780	1.260	0.613	0.458	7.374	0.633	1.713
Caprylic acid (8:0)	1.186	1.811	4.196	2.481	5.941	9.634	1.465
Capric acid (10:0)	0.203	0.429	0.993	0.741	1.395	0.779	0.460
Undecanoic acid (11:0)	0.539	0.890	2.635	0.482	0.990	2.769	0.881
Tridecanoic acid (13:0)	-	-	-	-	-	0.315	-
Myristic acid (14:0)	0.439	0.763	2.441	0.410	1.886	2.116	0.713
Palmitic acid (16:0)	1.998	6.420	7.702	3.054	2.620	1.186	3.391
Palmitoleic acid (16:1)	0.487	0.794	2.408	0.502	1.671	1.880	0.715
Heptadecanoic acid (17:0)	0.045	-	0.248	0.098	-	-	0.081
Cis-10Heptadecanoicacid (17:1)	0.073	-	0.392	0.102	-	-	0.065
Stearic acid (18:0)	0.843	2.260	6.797	1.797	2.220	0.836	2.575
Elaidic acid (18:1,t)	0.043	0.661	2.694	-	0.425	-	0.340
Oleic acid (18:1,c)	51.740	17.420	29.960	19.400	20.560	5.784	0.480
Linoelaidic acid (18:2,t)	0.370	0.181	0.272	0.195	-	0.313	0.225
Linoleic acid (18:2)	31.330	31.081	6.228	36.330	29.800	3.230	3.210
Arachidic acid (20:0)	0.046	0.109	-	0.651	0.723	-	0.795
g-linoleic acid (18:3 n6)	-	0.131	-	-	-	-	-
Eicosenoic acid (20:1)	0.194	26.000	2.728	15.560	8.507	5.354	4.910
Linolenic acid (18:3,n3)	0.259	0.168	-	0.227	-	-	0.305
Heneicosanoicacid (21:0)	-	0.247	0.496	-	-	-	-
Behenic acid (22:0)	-	-	-	0.128	-	-	0.092
Eicosatrienoic acid (20:3,n6)	0.490	0.050	2.773	0.485	2.067	2.133	0.807
Erucic acid (22:1,n9)	0.039	0.107	0.322	-	-	-	0.064
Tricosanoic acid (23:0)	-	-	0.359	-	-	-	-
Nervonic acid (24:1)	0.697	1.178	3.573	0.677	3.133	3.099	1.192
Docosaheksaenoicacid (22:6,n3)	0.093	0.532	1.139	0.138	0.849	1.809	0.224

the highest content (31,081%) of linoleic acid (fatty acid of ω-6) and the lowest content (0.109%) of arachidic acid (C20:0). Otherwise, YL 08 rose hip genotype had the highest content (5,784%) of oleic acid and the lowest content (0.248) of heptadecanoic acid (C17:0).

Ozcan (2002) reported that *Rosa canina seeds* contain 1.71 to 3.17% palmitic acid, 1.69 to 2.47% stearic acid, 14.71 to 18.42% oleic acid, 48.64 to 54.41% linoleic acid and 16.42 to 18.41% linolenic acid, while Zlatanov (1999) observed 17.8% palmitic acid, 2.6% palmitoleic acid and 52.6% oleic acid contents in the seeds of *Rosa canina*. The percentage distribution of fatty acid components detected for five genotypes in this work had some similarities and differences from those of other studies (Ercisli et al., 2007; Ozcan, 2002). Fatty acid contents for *Rosa canina,* which is one of the most studied species, can vary according to researches. For example, it was found as 51.18% linoleic acid (ω-6) and 18.13% linolenic acid (ω-3) in *Rosa canina* genotypes by Ercisli et al. (2007). In this study, linoleic acid (ω-6) content was found as 6.228%, while linolenic acid (ω-3) was not found in seedless rose hip genotype. The results varied according to the species or the genotypes. Otherwise, Gigienova et al. (1969) reported that *Sambucus nigra* (Elderberry) seeds contain 38.49% linoleic acid (ω-6) and 36.25% linolenic acid (ω-3). The findings of these researchers were different from those of this study. Our findings show 31.81% linoleic acid (ω-6) and 0.168% linolenic acid (ω-3) in *Sambucus nigra.* Yusunova et al. (1998) reported that *Viburnum opulus* L. (Guelder rose) seeds content contained 49.50% of 18:2 linoleic acid (ω-6). However, this study's findings show 51.740% of 18:1 oleic acid in *Viburnum opulus* L. These similarities and differences could be attributed to different climate, soil, ecological conditions and also genetical factors by different researchers.

Conclusion

According to the data obtained at the end of this study, although, it was found that the differences in fatty acid compositions of the species and the genotypes used in the study, ratios of oleic and linoleic acid and especially ratios of unsaturated fatty acids used were high found. Accordingly, it was determined that these berries were

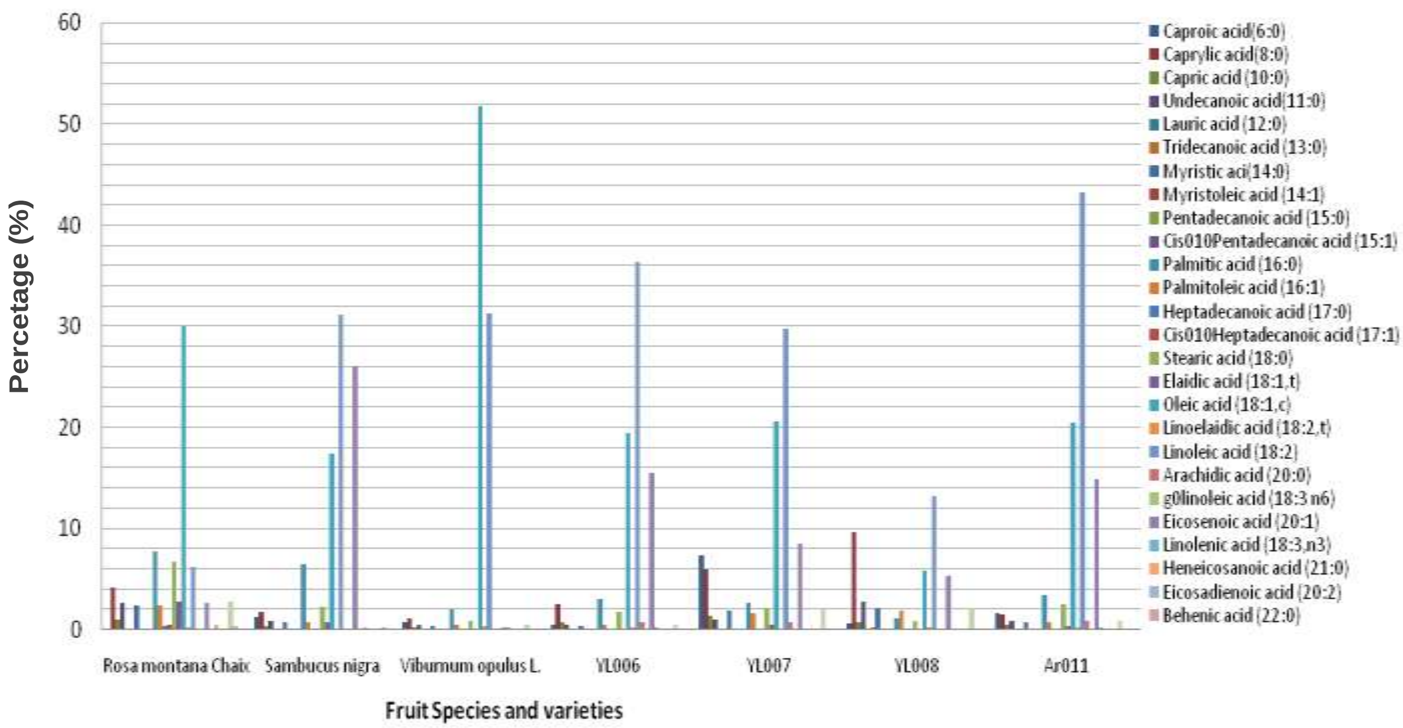

Figure 1. Fatty acids composition in seeds of some ımportant berry species and genotypes.

important in terms of human health.

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