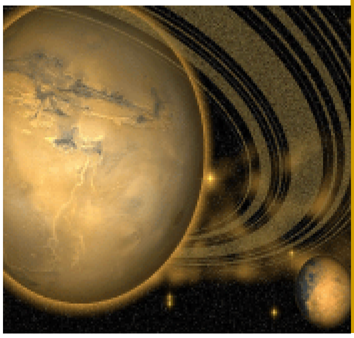

Account
View Cart
Home | Books | Series | Journals | Reference | eBooks | Information
Sales | Imprints | for Authors

Top » Catalog » Ebooks » Biomedical Sciences » Biology » Nutrition »

My Account | Cart Contents | Checkout

Linoleic Acid: Sources, Antioxidant Properties and Health Benefits

$150.00

Editors: Igho Onakpoya (Research Associate in Pharmacovigilance Department of Primary Care Health Sciences University of Oxford, Oxford

Book Description:

This book contains information on the latest research on linoleic acid composition, in a wide range of dietary sources, as well as advancements in food technology to ensure better nutritional quality of LA. Biochemists, nutritionists, dieticians, food industry technologists, clinicians, and allied health professionals will find the information in this book essential and immensely valuable. Topics discussed include: natural sources of linoleic acids (LA); variations in the LA content of plant and animal products; extraction methods for LA; plant adaptation in the polar region and its effect on LA composition in agricultural animals; the effect of geographical variation on consumer preferences for olive oil types; the influence of plant lipids on the LA composition of animal fat; the oxidation kinetics of LA; the potential benefits of LA isomers in treatment of obesity, ischemic stroke and atopic dermatitis; and the possible mechanisms linking LA with the development of various types of cancers. (Imprint: Nova Biomedical)

Table of Contents:

Tell someone you know about this product.

Emulsion and Microcapsule Systems
(Yoshiyuki Watanabe, Yasumasa Minemoto and Shuji Adachi)

Chapter 4: Linoleic and other Fatty Acids, Cryoresistance, and Fodder Value of Yakutian Plants
(Klim A. Petrov, Aleksandr A. Perk & Valentin A. Chepalov)

Chapter 5: Influence of Variety, Geographical Site and Extraction System on Virgin Olive Oil (VOO) Linoleic Acid Composition and its Impact on Consumer Preference
(Kaouther Ben Hassine, Amani Taamalli, Dhafer Malouche, Naziha Kammoun, Aida Lazzez, Cinzia Benincasa, Giovanni Sindona, Enzo Perri, Mohamed Hammami & Mohamed Bouaziz)

Chapter 6: The Effect of Conjugated Linoleic Acid (CLA) Supplementation on Body Anthropometric Measures
(Igho Onakpoya and Edzard Ernst)

Chapter 7: Conjugated Linoleic Acid in the Prevention of Ischemic Stroke
(Yuri Clement)

Chapter 8: Gamma Linolenic Acid and Atopic Dermatitis
(Igho Onakpoya & James A. Taylor)

Chapter 9: Modulation of Carcinogenesis and Inflammation by Linoleic Acids and its Derivatives
(Túlio César Ferreira & Élida Geralda Campos)

Chapter 10: Linoleic Acid and Cancer
(Gerard G. Dumancas, Raluca Mateescu, Elmer-Rico E. Mojica & Rachel Murphy)

Index

Series:
Nutrition and Diet Research Progress
Binding: ebook
Pub. Date: 2012 4th Quarter
Pages: 7 x 10 (NBC - C)
ISBN: 978-1-62257-399-8
Status: AN

Status Code	Description
AN	Announcing
FM	Formatting
PP	Page Proofs
FP	Final Production

EP	Editorial Production
PR	At Prepress
AP	At Press
AV	Available

Available Options:

Version: Download: Windows - English

Add to Cart

Friday 01 June, 2012

In: Linoleic Acids: Sources, Biochemical Properties and Health Effects ISBN
Editor: Igho Onakpoya. © 2012 Nova Science Publishers, Inc.

Chapter

INFLUENCE OF VARIETY, GEOGRAPHICAL SITE AND EXTRACTION SYSTEM ON VIRGIN OLIVE OIL (VOO) LINOLEIC ACID COMPOSITION AND ITS IMPACT ON CONSUMER PREFERENCE

Kaouther Ben Hassine[1,2,3], Amani Taamalli[4] , Dhafer Malouche[5], Naziha Kammoun[2], , Aida Lazzez[2], Cinzia Benincasa[6], Giovanni Sindona[6], Enzo Perri[6], Mohamed Hammami[1] & *Mohamed Bouaziz[8]

[1]Biochemistry Laboratory - UR03/ES08 ‘Human Nutrition and Metabolic Disorders USCR ‘Mass Spectrometry Lab of Monastir Medicine University’, Tunisia
[2]Sfax olive Institute, Tunisia
[3]National Institute for Applied Sciences and Technologies, Tunisia
[4]Centre of Biotechnology of Borj Cedria (CBBC), Tunisia
[5]School of Statistics and information Analysis, Tunisia
[6]CRA Experimental Institute for Olive Growing, C. da Li Rocchi, 87036 Rende (CS), Italy,
[7]Dipartimento di Chimica, Università della Calabria, Italy
[8]Laboratory of Electrochemical and Environnement, National Ingenier School of Sfax, BP »1173 » Sfax, University, 3038-Tunisia.

ABSTRACT

Virgin olive oil (VOO) is known for its unique taste and its effects on health due to its chemical composition. Fatty acid (FA) composition analysis is essential for the qualitative evaluation of VOO, as well as to ensure its authenticity and detect fraud. FA composition analysis is also useful for the classification of VOO and consequently for its commercialization. Studying the effects of the variety, climate, altitude and the degree of olive maturity is useful for improving VOO quality. The VOO FA composition differs from one cultivar to another depending on the region. This chapter aimed at evaluating the effect of the variety, geographical site, and the extraction system on the linoleic acid composition, sensory attributes and consumer preferences. Arbequina and Chemlali olives in same stage of maturity were harvested from various localities in Tunisia. The quality, FA composition, oxidative stability, sensory profile and consumer preferences were estimated using standardized methods. The percentage of linoleic acid ranged from 6.83% to 19.20% in Tunisian and foreign varieties (Coratina and Arbequina). The lowest concentration of linoleic acid was observed in the Italian Coratina variety. A significant effect of the extraction system was observed for major FFA (free fatty acids): oleic, linoleic, palmitic acids. Analysis of the effect of interaction between the extraction system and the geographical site on analytical parameters revealed significant statistical differences ($p<0.05$) in the FFA. Peroxide index, oxidative stability and extinction index K270 showed statistically significant differences ($p<0.005$) with respect to extraction system while extinction index K232 was significantly affected only by geographical site. FA composition revealed statistically significant differences ($p<0.005$) with respect to the interaction between the geographical site and the extraction system in palmitoleic, stearic and linoleic acid, whereas palmitic and oleic acids were affected only by geographical site. Arbequina olive oils extracted by pressure system (SP) showed defects principally musty, metallic and rancid. Other negative attributes such as rancidness and mustiness were the principals defects found in Chemlali olive oils extracted by SP system. In contrast, oils obtained by dual and triple-phase systems showed positive attributes of fruitiness, bitterness and pungency without defects. The consumer preference analysis revealed that Arbequina VOO obtained by 2P extraction system was the most preferred followed by oils obtained by 3P and SP systems respectively. Arbequina and Chemlali oils which are rich in linoleic acid were more preferred by consumers.

Keywords: Linoleic acid; fatty acid composition; virgin olive oil; consumer preferences; pressure system; dual and triple-phase systems; sensory profile

Abbreviations: VOO-virgin olive oil; FA-fatty acid; SP-pressure system; 2P-dual phase; 3P-triple phase; FFA-free fatty acids; PI-peroxide index

*Email: mohamed.bouaziz@fsg.rnu.tn

INTRODUCTION

The Mediterranean area is the major international olive-growing area with 98% of the world's *Olea europaea* L. tree plantation [1]. In fact this tree is a typical one widely cultivated for oil production. Tunisia accounts for 57 million of such trees covering 12623 hectares. The most abundant olive variety is *O. europaea* L. cv. Chemlali, which represents more than 60% of the total olive trees [2].

Because of their natural bitterness, olives are rarely consumed as a natural fruit. They are commonly used for the extraction of oil and often as table olives. The decreased incidence of cardiovascular disease in the Mediterranean area is partly attributed to the consumption of olive products principally virgin olive oil (VOO) [3].

VOO possesses a characteristic aroma, taste and colour which distinguish it from other vegetable oils. VOO consumption is currently increasing thanks to its excellent organoleptic and nutritive qualities such as protection from cardiovascular disease and growing consumer preference for minimally processed foods. In fact, VOO is a valuable vegetable oil which is produced without any preliminary refining process [4]. It is extracted from fresh and healthy olive fruits by mechanical and other physical methods (washing, decantation, centrifugation or filtration). These technological procedures, if correctly adopted, are able to preserve the quality of VOO especially its delicate flavor which is highly regarded by the consumer.

The main VOO-producing countries have been particularly active in recent years at studying the chemical composition of VOO varieties or oil produced in a specific area and how this relates to oil quality [5]. VOO has a well-balanced composition of fatty acids (FA), mainly because of the high content of oleic acid, the high ratio of monounsaturated and polyunsaturated FA and the presence of minor compounds that makes it both fairly stable against oxidation, making it very suitable for human consumption.

The FA composition analysis is essential for the qualitative evaluation of VOO. It is also one of the ways to ensure the authenticity of VOO and detect fraud. It is of great importance for the classification of VOO and consequently for its commercialization. However, several studies have reported that the quality of VOO depends on many factors: olive tree cultivation, harvesting, pedoclimatic conditions, olive cultivar and processing technique and number of steps required for it; mainly crushing, malaxation and centrifugation [5,6,7,8]. Thus, studying the effects of such factors on the chemical composition of VOO is of interest in order to improve VOO quality.

This chapter aims at examining the effect of the variety, geographical site, and the extraction system on the linoleic acid composition, sensory attributes and consumer preferences.

Samples

Arbequina olives were harvested from six localities in Tunisia (Tastour, Fendek jdid, Tela, Grombalia, Sidi Bouzid and Zaghouan) and Chemlali olives were harvested from seven localities (Sawef, Moknine, Barone, Sidi Bouzid, Chaal, Chrarada and Taous) at the same ripeness stage. Olive fruits were processed in industrial olive mill by different extraction systems: pressure system (SP), dual-phase (2P) and triple-phase (3P) decanters. The obtained oils were directly transferred into dark glass bottles and stored for quick analysis.

Quality Indices

Free acidity, peroxide index (PI) and UV spectrophotometric indices (at 232 and 270 nm) were determined according to the European Communities official methods [[9]].

Fatty Acid Composition

Fatty acid methyl esters (FAMEs) from the oil samples were estimated as described by Issaoui et al. [[10]]. Individual FAMEs were separated and quantified by gas chromatography (Hewelett-Packard Ca Palo Alto, Calif) equipped with a flame ionisation detector, and a fused silica capillary column CP-SIL (50m length x 0.25mm i.d. and 0.25µm of film thickness).

Oxidative Stability

Oxidation stability was evaluated by the Rancimat apparatus (Mod. 743, Metrohm Switzerland Ω) using an oil sample of 3g warmed to 120°C and an air flow of 20l/h. Stability was expressed as oxidative stability index (hours).

Sensory Analysis

Sensorial evaluation of the oils was performed according to the Panel test method (COI, 1996) by a fully trained analytical taste panel recognized by the International Olive Oil Council (IOOC). A panel test was established using a standard profile sheet method, (COI/T.20/Doc.15/Rev1, 1996).

Hedonic study

A panel of 620 consumers (women and men) with an average age of 16 years to 60 years was assembled for this study. A specific investigation sheet was available for the consumers. The consumers were asked to fill out a form and give a grade ranging from 0 to 20.

Statistical Analysis

Statistical analyses were performed using the XLSTAT software v.2011 (Addinsoft). For consumer preference analysis we used SPSS 10.0 for windows.

Physicochemical variations of VOO based on geographical site and extraction system

Based on the numerous parameters considered by regulation EC2568/91 for the merceological classification of olive oils, our results showed that all the mono varietal olive oil samples analysed were labelled as "extra virgin" (data not shown). Analysis of the effect of interaction between the extraction system and the geographical site for the two cultivars Chemlali and Arbequina revealed statistically significant differences ($p<0.05$) in few parameters mainly the free fatty acids (FFA). PI, oxidative stability and extinction index

K270 showed significant difference ($p<0.005$) with respect to extraction system while extinction index K232 was significantly affected only by geographical site. The Principal component analysis (PCA) in figure 1 shows that acidity from Chemlali oils extracted by SP was higher than that from 2P and 3P systems irrespective of geographical site. A similar result was observed for Arbequina oils (figure 2). It is important to note that there was no significant difference between oils extracted by 2P and 3P systems.

These results corroborate those reported by Torres & Maestri [7,8]. In their study, they explained that in SP system, oil and the vegetable water are extracted and remain together until they are separated by decanting. This prolonged exposure of lipid phase to aqueous phase and solid wastes favour the hydrolysis of triglycerides, resulting in an increase of free FA level. Conjugated dienes (K232) and trienes (K270), and PI are indicators of oxidative deterioration of oils. The highest values of these two indicators are obtained for oils extracted with SP system.

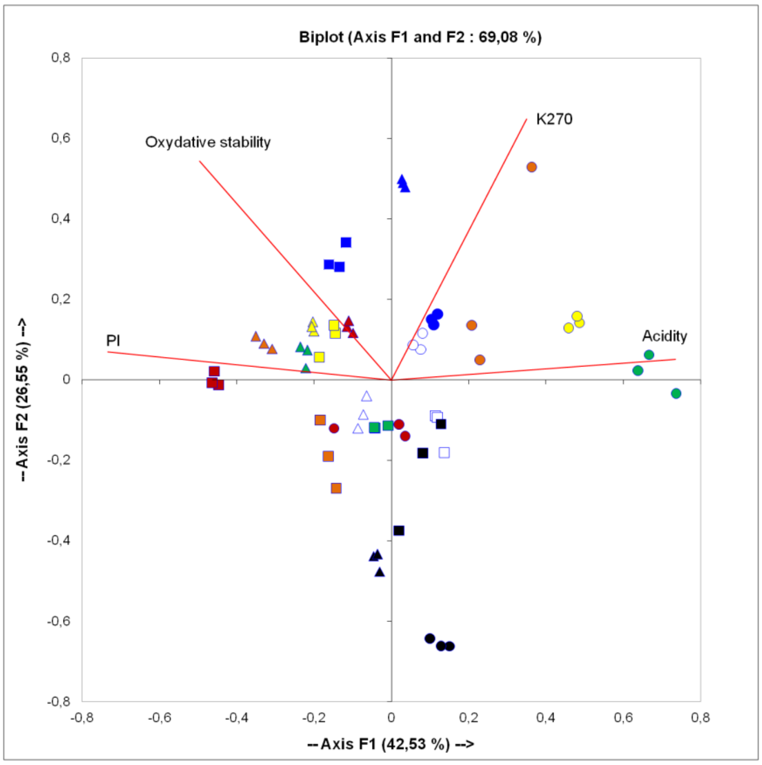

Figure 1 : Principal Component Analysis of physicochemical parameters of virgin olive oil related to geographical site and extraction system for Chemlali cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours correspond to different geographical sites: Blue for Sawef, Red for Moknine, Yellow for Barone, Green for Sidi Bouzid, Black for Chaal, Orange for Chrarada and White for Taous.

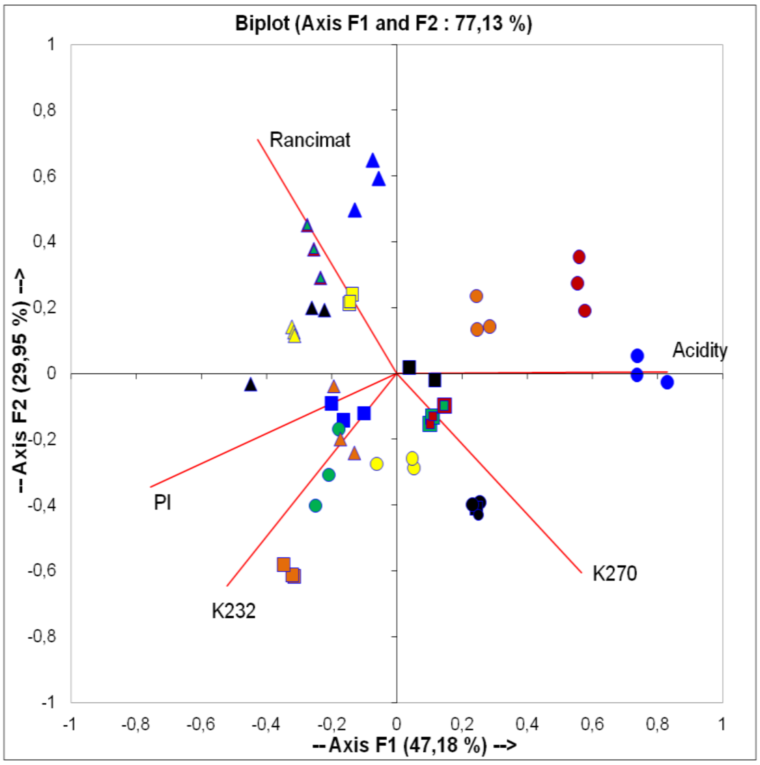

Figure 2 : Principal Component Analysis of physicochemical parameters of virgin olive oil related to geographical site and extraction system for Arbequina cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours are correspond to different geographical sites: Blue for Tela, Red for Grombalia, Yellow for Tastour, Green for Sidi Bouzid, Black for Fendek Jdid and Orange for Zaghouan.

Fatty acid composition of VOO

Fatty acid composition revealed statistically significant differences ($p<0.005$) with respect to the interaction between the geographical site and the extraction system in palmitoleic, stearic and linoleic acids, whereas palmitic and oleic acids were affected only by geographical site. For multivariate analysis of VOO FA composition, PCA was used to assess characterize or classify the oils according to their geographical site and extraction system. The PCA (figures 3 and 4) revealed that VOO is classified by geographical site rather than by extraction system. Arbequina olive oils from Sidi bouzid were characterized by higher levels of linoleic acid whereas Arbequina olive oils from Tela were characterized by higher levels of oleic acid.

The percentage of linoleic acid ranged from 6.83% to 19.20% in Tunisian and foreign varieties (Coratina and Abequina). If we classify oil samples by geographical region into North, Center and South Tunisia, the study shows that there is a noticeable difference in palmitic acid moving from the North to the South. The lowest concentration of linoleic acid was observed in the Italian Coratina variety, one of the most important varieties of the Central region. The highest value of palmitic acid is observed in oils from the Southern regions while the lowest is observed in oils from the Northern regions. Many previous studies have shown that the higher the linoleic acid content of olive oil, the more rapid its oxidation occurs. This makes us conclude that the oils from the North are more resistant to oxidation than oils from the South.

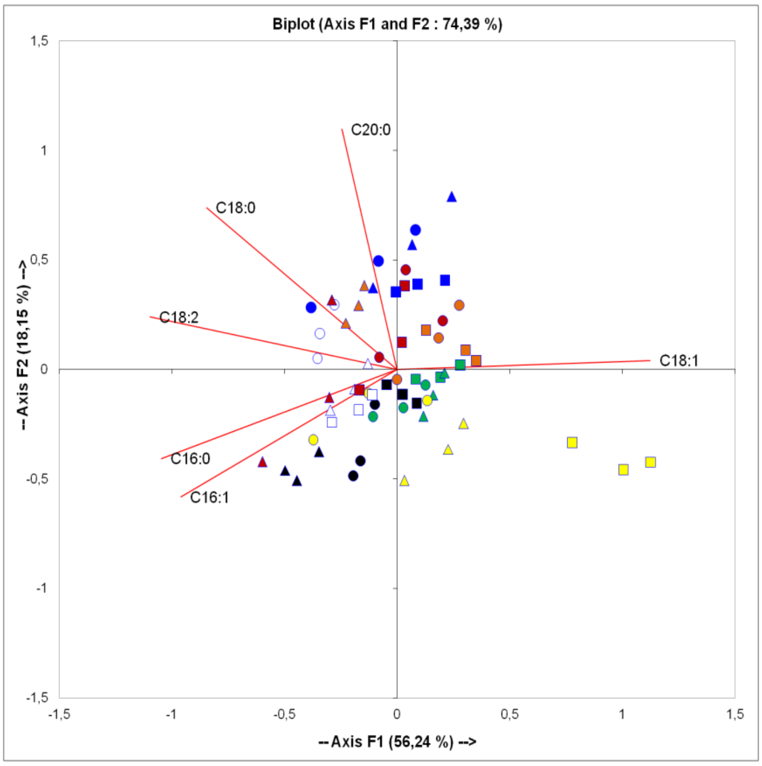

Figure 3 : Principal Component Analysis of fatty acid composition of virgin olive oil related to geographical site and extraction system for Chemlali cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours correspond to different geographical sites: Blue for Sawef, Red for Moknine, Yellow for Barone, Green for Sidi Bouzid, Black for Chaal, Orange for Chrarada and White for Taous.

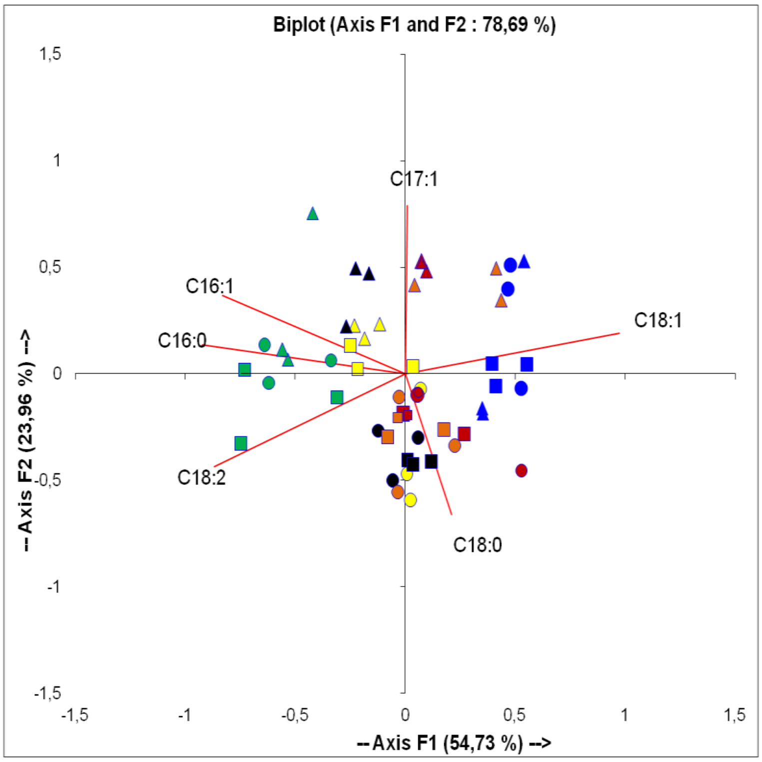

Figure 4 : Principal Component Analysis of fatty acid composition of virgin olive oil related to geographical site and extraction system for Arbequina cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours correspond to different geographical sites: Blue for Tela, Red for Grombalia, Yellow for Tastour, Green for Sidi Bouzid, Black for Fendek Jdid and Orange for Zaghouan.

Sensory profile of VOO

Statistical analysis showed that presence of defects detected by the panel was dependent principally on extraction system in Chemlali olive oils (figure 5). Oils extracted by continuous systems (2P and 3P) rarely showed negative attributes in Chemlali cultivar whereas for some localities, olive oils extracted by 2P and 3P systems revealed some defects in Arbequina cultivar (figure 6). This correlates with our statistical analysis which showed that sensory profile for Arbequina oils was related to the interaction between extraction system and geographical site, with a dominant effect of extraction system. We observed that all Arbequina olive oils extracted by SP system showed defects principally musty, metallic and rancid. Rancidness and mustiness were also the principals defects found in Chemlali olive oils extracted by SP system. These defects are related to the prolonged exposure of oil to aqueous phase that increase the apparition of these defects.

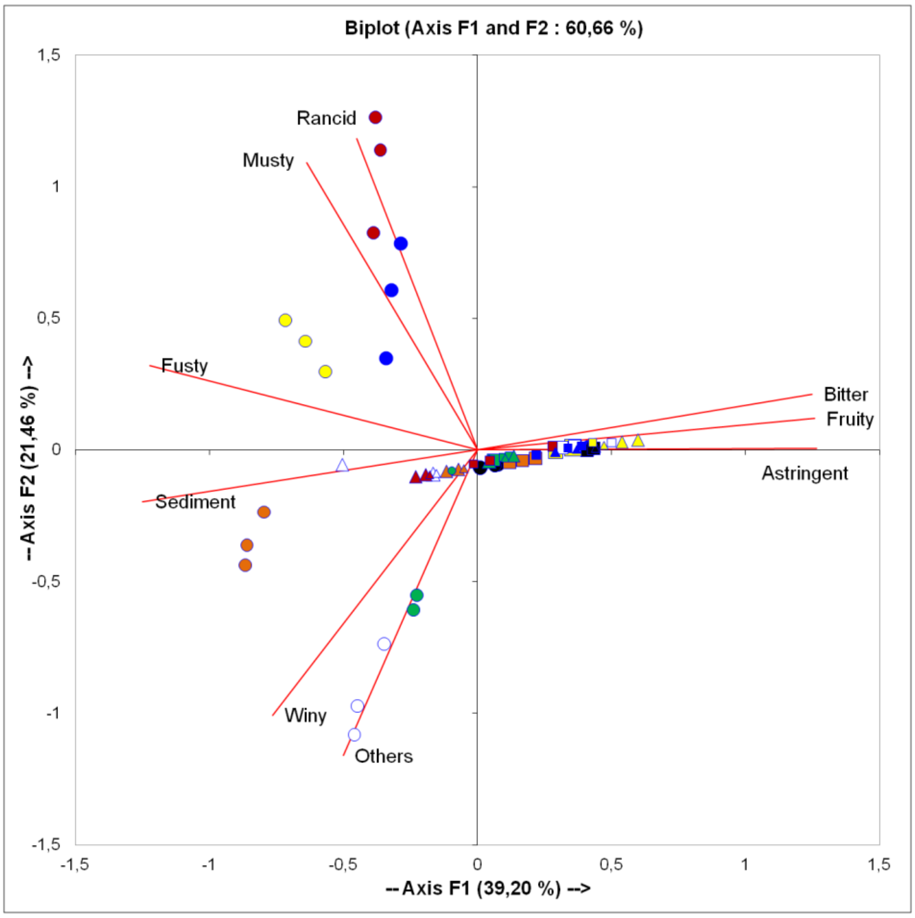

Figure 5 : Principal Component Analysis of Fatty acid composition of virgin olive oil related to geographical site and extraction system for Chemlali cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours correspond to different geographical sites: Blue for Sawef, Red for Moknine, Yellow for Barone, Green for Sidi Bouzid, Black for Chaal, Orange for Chrarada and White for Taous.

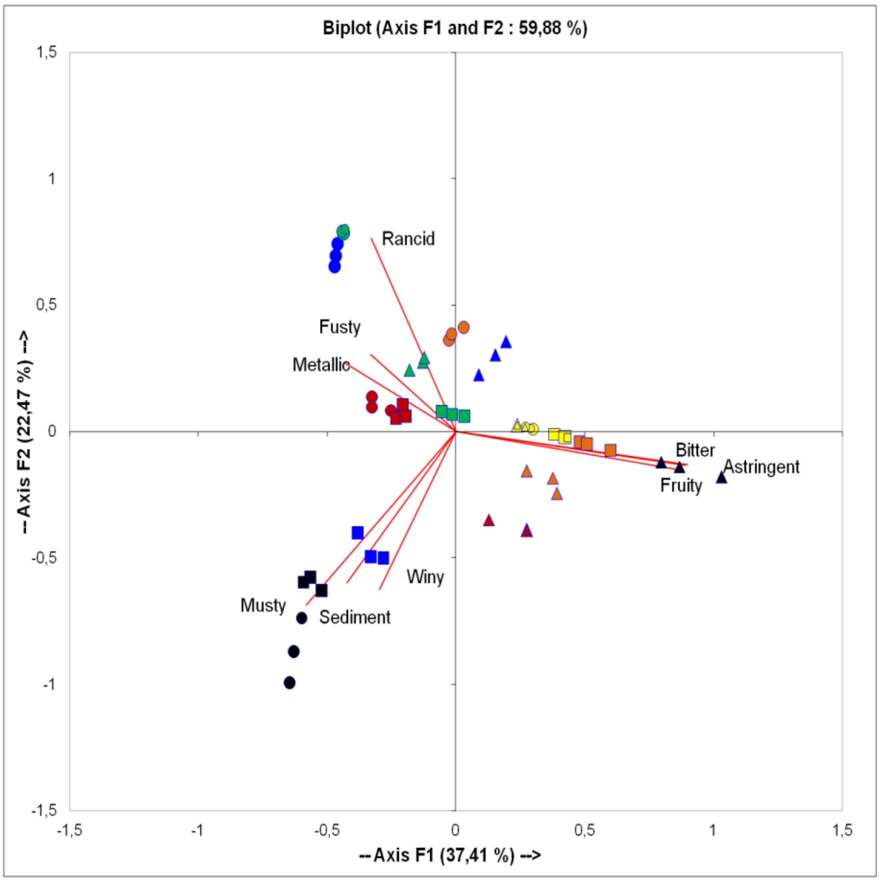

Figure 6 : Principal Component Analysis of sensory attributes of virgin olive oil related to geographical site and extraction system for Arbequina cultivar. Circles correspond to oils extracted by SP system, squares to oils extracted by Dual-phase system and triangles to those extracted by Triple-phase system. Colours correspond to different geographical sites: Blue for Tela, Red for Grombalia, Yellow for Tastour, Green for Sidi Bouzid, Black for Fendek Jdid and Orange for Zaghouan.

Consumer preferences

Consumers gave disgusted oil rating notes from 0 to 20. A Pearson test was used to determine if locality has an effect on consumer preferences.

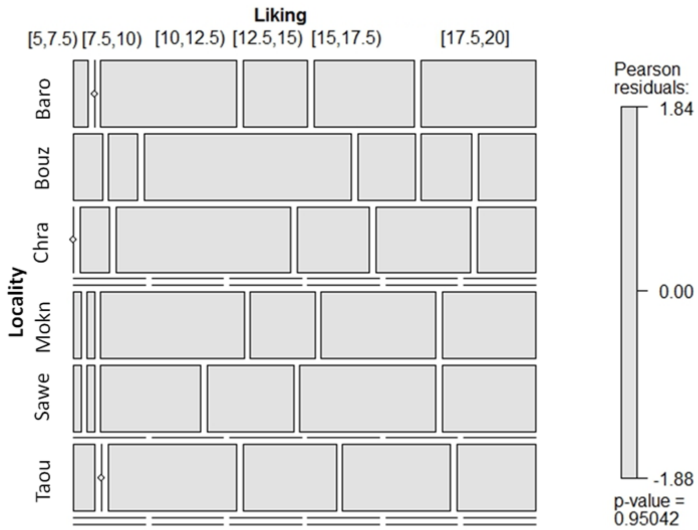

Figure 7 : Pearson test for consumer preferences related to geographical site of Chemlali olive oils.

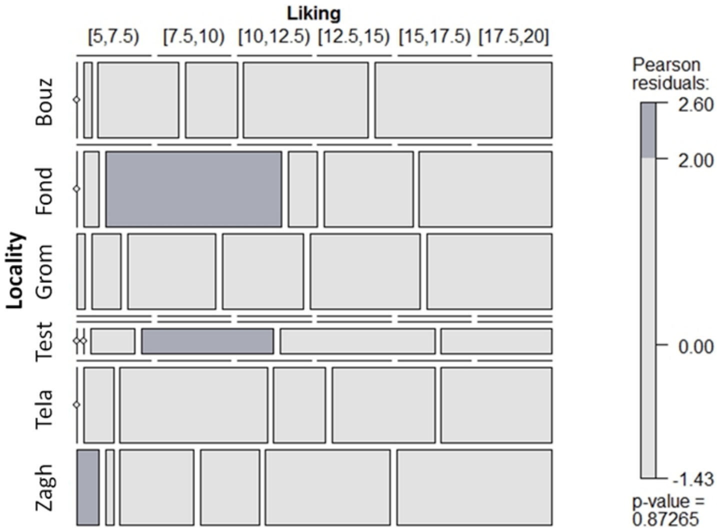

Figure 8 : Pearson test for consumer preferences related to geographical site of Arbequina olive oils.

The results showed that the geographical site of Chemlali and Arbequina olive oils had no significant effect on the consumer preferences (figures 7 and 8). However, Arbequina olive oils from Fendek jdid, Zaghaoun and Tastour had more frequent bad and median scores compared to other samples. The absence of a significant effect could have been due to the choice of statistical test.

Linoleic acid content and consumer preference related to cultivar and extraction system

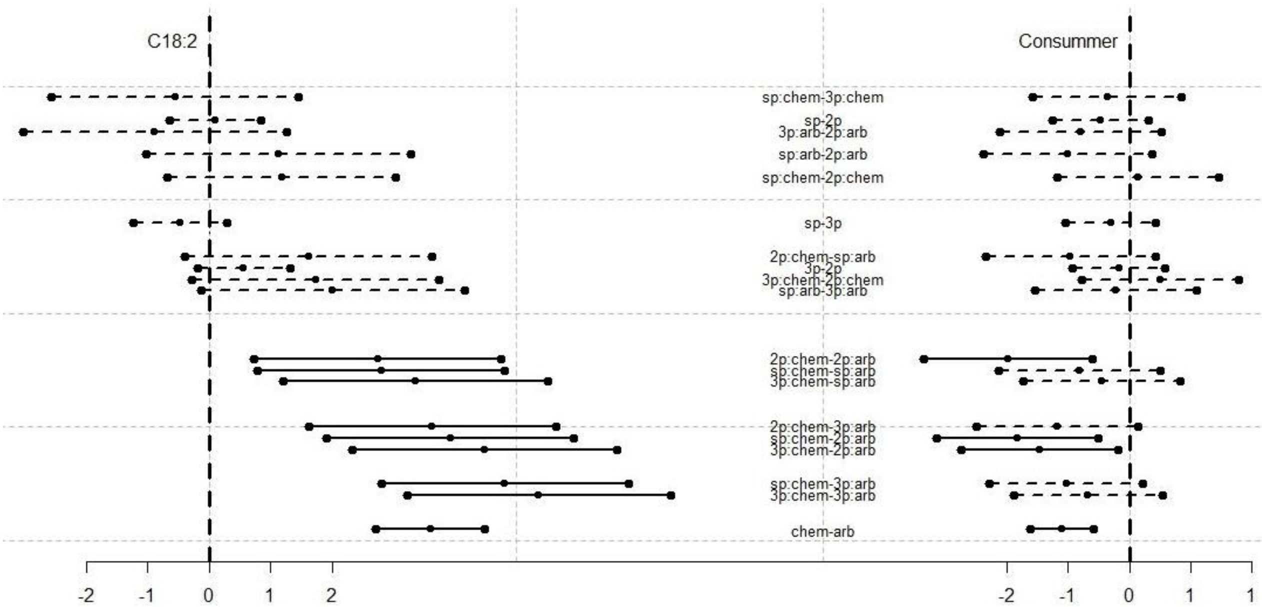

Figure 9 : Pearson test for consumer preferences and Linoleic acid content in olive oils from Chemlali and Arbequina cultivars related to extraction system

For linoleic acid content and consumer preferences, there was a significant dominant effect of extraction system (figure 9). Arbequina cultivar presented a higher content of linoleic acid than Chemlali cultivar. However, consumers showed a preference for oils from Chemlali cultivar. This suggests that there’s a potential relationship between consumer preferences and linoleic acid content.

CONCLUSION

VOO has unique characteristics which are due to its chemical composition. Its FA composition makes it very suitable for human consumption, and can also be used to classify it and ascertain its authenticity. The properties of VOO are influenced by the extraction methods as well as geographical location of the olive, and consequently affect the preferences of consumers. .

Regardless of the extraction system, oils from Arbequina showed higher content of linoleic acid. The extraction system also had a dominant effect on the sensory profile of Arbequina oil. Consumers showed a greater preference for oils from Chemlali cultivar.

REFERENCES

[1] Ryan, D., Robards, K. 1998. Phenolic compounds in olive. Analyst, 123: 31R-44R
Salvador, M.D., Aranda, F., Gómez-Alonso, S., Fregapane, G. 2003. Influence of extraction system, production year and area on Cornicabra virgin olive oil: a study of five crop seasons. Food Chemistry, 80: 359–366.

[2] Khlif, M., Ayadi, M., Grati-Kammoun, N., Arous, M. N., Rekik, H., Hamdi, M. T., Rekik-Fakhfakh, B. 2002. Identifying chemlali olive variety in its traditional area. Acta Hortic, 586: 117-120

[3] Visioli, F., Poli, A., Galli, C. 2002. Antioxidant and other biological activities of phenols from olives and olive oil. Med. Res. Rev, 22: 65-75

[4] Olias, J. M., Perèz, A. G., Rios, J. J., Sanz, L. C. 1993. Aroma of virgin olive oil: biogenesis of the “green” odor notes. J. Agric. Food Chem. 41: 2368–2373.

[5] Salvador, M.D., Aranda, F., Gómez-Alonso, S., Fregapane, G. 2003. Influence of extraction system, production year and area on Cornicabra virgin olive oil: a study of five crop seasons. Food Chemistry, 80: 359–366.

[6] Cerretani, L., Bendini, A., Rotondi, A., Lercker, G., Toschi, T.G. 2005. Analytical comparison of monovarietal virgin olive oils obtained by both a continuous industrial plant and a low-scale mill. European Journal of Lipid Science and Technology, 107: 93–100.

[7] Torres, M.M., Maestri, D.M. 2006. Chemical composition of Arbequina virgin olive oil in relation to extraction and storage conditions. Journal of the Science of Food and Agriculture, 86 : 2311–2317.

---

[8] Torres, M.M., Maestri, D.M. 2006. The effects of genotype and extraction methods on chemical composition of virgin olive oils from Traslasierra Valley (Cordoba, Argentina). Food Chemistry, 96: 507–511.

[9] EEC. 1991. Commission Regulation EC no 2568 ⁄ 91 July 11, 1991. Official Journal of the European Communities, L 248, 001–0082

[10] Issaoui, M., Dabbou, S., Brahmi, F., Ben Hassine, K., Hajaïj Ellouze, M., Hammami, M. 2009. Effect of extraction systems and cultivar on the quality of virgin olive oils. International Journal of Food Science and Technology, 44: 1713–1720