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THE OPTIMAL CONTENT OF FATTY ACIDS FOR HEALTHY NUTRITION

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Abstract: Starting from the traditional Mediterranean diet, which is characterized by a high intake of monounsaturated fats, a low intake of saturated fats, a moderate intake of polyunsaturated fats and long-chain omega-3 fatty acids, a solution could be found to ensure the optimal intake of fatty acids. The present study reviews the fatty acid profile of olive oil and walnut oil samples, proposing to identify the optimal ratio of monounsaturated fatty acids/polyunsaturated, respectively omega-6/omega-3 fatty acids.

• Introduction

The calories obtained from eaten or stored carbohydrates are consumed by the body during physical activities. But after about twenty minutes, fat-derived calories provide the energy needed to keep on exercising. Food fats provide the body with essential fatty acids.

Starting from the traditional Mediterranean diet, which is characterized by a high intake of monounsaturated fats, a low intake of saturated fats, a moderate intake of polyunsaturated fats and long-chain omega-3 fatty acids, a solution could be found to ensure the optimal intake of fatty acids.

The present study reviews the fatty acid profile of olive oil and walnut oil samples, both major components of the Mediterranean diet, as well as their mixtures in different proportions, proposing to identify the proportion that ensures the optimal ratio of monounsaturated fatty acids/polyunsaturated, respectively omega-6/omega-3 fatty acids.

• Material and method

The profile of fatty acids as methyl esters was determined for organic and conventional extra virgin olive oil, organic and conventional walnut oil, respectively for mixtures obtained from organic extra virgin olive oil and organic walnut oil in a ratio of 1:1, 2:1, 1:2, 4:1. In order to identify the fatty acid methyl esters (FAMES), a Shimadzu GCMS-QP2010 PLUS (Shimadzu Corporation, Kyoto, Japan) with RT2560 column (100 m × 0.25 mm × 0.20 μm), from the Interdisciplinary Research Platform of University of Life Sciences "King Michael I" from Timisoara was used.

Briefly, 0.1 g of oil sample 3 mL of 20% boron trifluoride (BF₃) in methanol (Merck KGaA, Darmstadt, Germany) was added and maintained in a water ultrasonic bath at 80°C (FALC Instruments, Treviglio, Italy) for one hour. 2.5 mL of sodium chloride solution of 10% and 2 mL of hexane were added to each sample, then were centrifuged at 3000 rpm for 15 min, and the FAMES from the hexane fraction (1 mL) were used for GC-MS analysis. The flow rate of the carrier gas (Helium) was 1 mL·min⁻¹, and the splitting ratio was 1:50. The column temperature (100°C) was maintained for 5 min, and then a gradient at 3°C/min until 250°C was maintained for 10 min.

The injection port temperature was 250°C, and the temperature of the ion source and the GC-MS interface was 210°C and 255°C. Fatty acids were identified based on the NIST 05 spectrum library. The fatty acid composition was expressed using the peak area normalization method by relating the peak area corresponding to a given compound to the total area of all peaks. All the analyses were conducted in three replicates. Saturated fatty acids (SFA) were calculated based on the sum of C16:0-C20:0, monounsaturated fatty acids (MUFA) were calculated as the sum of C16:1-C18:1, and polyunsaturated fatty acids (PUFA) were calculated as the sum of C18:2, C18:3. Unsaturated fatty acids (UFA) were calculated as the sum of MUFA and PUFA.

• Results and discussions

Table 1. Fatty acid composition of different variations of olive oil and walnut oil samples, as well as mixtures of the two (%)

Fatty acid composition	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8
	EVOO	OO BIO	WO BIO	WO MIX	OO BIO WO BIO 1:1	OO BIO WO BIO 2:1	OO BIO WO BIO 1:2	OO BIO WO BIO 4:1
Hexadecanoic acid, methyl ester	14,64	15,77	9	10,06	11,94	12,48	9,97	13,57
9-Hexadecenoic acid, methyl ester, (Z)-	1,01	1,31	1,65	2,59	3,22	2,68	2,47	2,73
Octadecanoic acid, methyl ester	4,57	5,07	3,12	3,73	3,19	3,85	3,49	3,89
9-Octadecenoic acid (Z)-, methyl ester	68,26	63,36	24,48	20,48	42,42	44,98	38,05	50,8
9,12-Octadecadienoic acid (Z,Z)-, methyl ester	9,46	12,76	47,67	48,15	31,51	29,28	36,39	24,2
Eicosanoic acid, methyl ester	0,8	0,55	0,13	0,17	0,43	0,41	0,42	0,65
9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	1,26	1,17	13,95	14,81	7,3	6,31	9,19	4,15
SFA	20,01	21,39	12,25	13,96	15,56	16,74	13,88	18,11
MUFA	69,27	64,67	26,13	23,07	45,64	47,67	40,52	53,53
PUFA	10,72	13,93	61,62	62,96	38,81	35,59	45,58	28,35
n6/n3	7,51	10,9	3,41	3,25	4,31	4,64	3,95	5,83

Gas chromatography-mass spectrometry (GC-MS) analysis showed that there is no significant difference between the fatty acid content of extra virgin olive oil (EVOO) and BIO olive oil, and the same is true for BIO walnut oil and walnut. In the case of the oil mixtures used in the experiment, the fatty acid profile is close to optimal for olive oil/walnut oil 1:2.

The results of Table 1 also show that the major component of olive oil is the 9-Octadecenoic acid (Z)-, methyl ester (also known as oleic acid), which is a monounsaturated fatty acid, and the walnut oil contains high amounts of linoleic acid (omega-6) and linolenic acid (omega-3), both of them being polyunsaturated fatty acids.

• Conclusions

The following conclusions were drawn: the ratio of mono- and polyunsaturated fatty acids in the human diet should be 1:2, and that of omega-6 and omega-3 fatty acids would ideally be 1:1. The weight of saturated fatty acids should not exceed 15% of a healthy diet. We recommend the balanced consumption of foods that contain considerable amounts of omega-6 (peanut butter, almonds, avocado oil, cashews, sunflower seeds) and omega-3 (salmon, flax seeds, chia seeds, oysters, mackerel). Walnuts, hemp seeds and soy beans are rich in both of these healthy fatty acids.

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