FACTORS DETERMINING THE ACCURACY EVALUATION OF INDEXES OF OIL QUALITY

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INTRODUCTION

Walnuts Juglans regia L are known as significant sources of vegetable oil beneficial for health.Walnut oil is mostly unsaturated, and unsaturated fatty acids are associated with beneficial effects on serum lipids. Compared with most nuts, which contain mostly monounsaturated fatty acids (MUFA), walnuts are highly enriched in omega-6 and omega-3 polyunsaturated fatty acids (PUFA), which are essential dietary fatty acids [6, 10].

Being rich in mono and polyunsaturated acids, walnut oil is unstable during storage. It is important to know the factors which determine its quality [2, 6, 7, 10]. Oil stability and quality depends on its chemical composition, especially the content of unsaturated fatty acids, as well as processing and storage conditions. During storage there are various physical, chemical and enzymatic changes that influence the quality of the walnut oil [6, 7].

1. THE CHEMICAL COMPOSITION OF WALNUT OIL

Walnuts contain about 65% lipids, however, considerable differences exist among varieties (range: 52–70%, w/w) [2, 7, 10]. Walnuts also contain 15.8% proteins, 13.7% carbohydrates, 4.1% water, and 1.8% ash (w/w) [2, 9)]. The fatty acid composition of walnut oil is unique compared with other tree nut oils for two reasons: walnut oil contains predominantly linoleic acid (49–63%) and a considerable amount of α-linolenic acid (8–15.5%). Other fatty acids contain oleic acid (13.8–26.1%), palmitic acid (6.7–8.7%), and stearic acid (1.4–2.5%) [2, 12].

The tocopherol content of walnut oil varies among different cultivars and extraction procedures and ranges between 268 mg/kg and 436 mg/kg. The predominant tocopherol isomer is γ-tocopherol (> 90%), followed by α-tocopherol (6%), and then β- and δ -tocopherols [2, 9]. Non-polar lipids constitute 96.9% of the total lipids in walnut oil, while the polar - 3.1%. The polar lipid fraction consists of 73.4% sphingolipids (ceramides and galactosyl ceramides) and 26.6% phospholipids (predominantly phosphatidyl ethanol amine) [11].

Walnut oil contains approximately 1.8 g/kg phytosterols, primarily β-sitosterol (85%), followed by Δ-5-avenasterol (7.3%), campesterol (4.6%), and, finally, cholesterol (1.1%) [2, 11].

2. FACTORS DETERMINING THE ACCURACY EVALUATION OF INDEXES OF OIL QUALITY

Noteworthy study by Tammy D. Crowe et al. Impact of Extraction Method on Yield of Lipid Oxidation products from Oxidized and Unoxidized Walnuts (2000) reveals: The qualitative and quantitative extraction of lipids is imperative to the success of the analytical procedure in examining the shelf life of high-fat foods, such as walnuts. The quality of fat-containing foods may be assessed by measuring indices of lipid oxidation, such as PV, conjugated dienes, FFA, and volatile compounds. The methods employed to extract lipids from oxidized foods may influence the values obtained from these oxidation products [12]. Extraction conditions, e.g. temperature, time, and type of solvent, have been shown to affect sensory quality [9], volatile content [1], and oxidative stability of the extracted oil [3, 4].

The PV of oil from oxidized walnut, extracted with chloroform / methanol, tended to be greater than the PV of the oil obtained by pressing the walnuts, but lower than that of the oil obtained by any other method of oxidized walnuts [9]. Table 1 includes: PV (meq/kg), Conjugated dienes (%), FFA (%), Hexanal Content (ppm), and Total Volatiles (count x 10^{-5}) of Oil Extracted by Various Methods from Unoxidized and Oxidized Walnuts [9].

Table 1. Quality Indicators of Oxidized and Unoxidized Walnut Oil Extracted by Various Methods [9].

	PV meq/kg	Conjugated dienes %	FFA (%)	Hexanal (ppm)	Total volatiles count x 10^{-5}
Unoxidized walnuts					
Hexane	0,91[b]	0,13[a]	0,20[a]	0	2,8[a]
Methylene chloride	1,01[b]	0,12[a]	0,26[a]	0	7,1[b]
Pressing	0,06[a]	0,11[a]	0,24[a]	0	10,3[b]
Chloroform/methanol	1,02[b]	0,12[a]	0,27[a]	0	14,5[c]
SC-CO_2 (Coleman)	0,99[b]	0,13[a]	0,23[a]	ND[b]	ND
SC-CO_2 (welding)	1,58[c]	0,19[b]	0,22[a]	ND	ND
Oxidized walnuts					
Hexane	9,41[b]	0,50[a]	0,40[b]	90,9(19,1)[a]	5,3[a]
Methylene chloride	8,61[b]	0,53[a]	0,23[a]	252,7(5,8)[b]	25,4[b]
Pressing	5,02[a]	0,46[a]	0,27[a]	554,0(10,3)[c]	31,5[b]
Chloroform/methanol	10,43[b]	0,50[a]	0,29[a]	627,2(2,5)[d]	160,0[c]
SC-CO_2 (Coleman)	8,73[b]	0,51[a]	0,28[a]	ND	ND
SC-CO_2 (welding)	12,37[c]	0,82[b]	0,59[c]	ND	ND

[a]*Values within a column for each category (unoxidized or oxidized) with the same letter are not significantly different P<0,05.*
[b]*ND, not detectable. Values in parantheses are percentages relative to total peak area.*

CONCLUSION

The methods employed to extract lipids from oxidized foods may influence the values obtained from these oxidative products.

Oil extraction by pressing was not quantitative and therefore may not lead to a representative sample, particularly in the presence of polar compounds such as hydroperoxides [1, 9].

Degradation compounds that can be identified by chemical and enzymatic oxidations and auto-oxidation of walnut oil are dependent of oil quality, extraction method, and the evaluation method used.

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Recommended for publication: 15.06.2012.