Proximate Neutral Lipid Composition of Niger (*Guizotia abyssinica* Cass.) Seed

MOHAMED FAWZY RAMADAN and JÖRG-THOMAS MÖRSEL

Institute of Food Chemistry, Technical University of Berlin, Berlin, Germany

Abstract

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Niger (*Guizotia abyssinica* Cass.) seed was extracted with hexane (H) and chloroform/methanol (CM) (2:1, v/v) to determine the effect of the solvent on the amount and composition of the recovered lipid. The amount of the total lipid (TL) extracted with H was 29.6% of the seed weight, while that extracted with CM was 49.9%. Column and thin-layer chromatographic procedures on Silica Gel were performed to fractionate the main neutral lipid (NL) subclasses. Fatty acid composition of the NL subclasses, triacylglycerol (TAG) molecular species, and sterol (ST) content were estimated. The NL amount was found to be higher (97% of TL) in the H extract than in the CM extract (93% of TL). TAG appeared to be the predominant NL subclass (89.7–91.9% of total NL). Linoleic acid (C18:2*n*-6) was the main fatty acid followed by oleic acid (C18:1*n*-9) as the second main unsaturated fatty acid, while palmitic acid (C16:0) was the major saturated fatty acid. With high temperature gas-liquid chromatography using a flame ionization detector (HTGLC/FID) and H_2 as the carrier gas, the actual TAG molecular species according to their carbon numbers were separated. TAG of even carbon numbers 16 and 18 were contained in six TAG molecular species. The major peaks occured at C54:6, and C54:3 corresponding to trilinolein and triolein. Furthermore, TAG molecular specie, expected to contain two molecules of linoleic acid (C54:5), was detected in a high level. Phytosterol pattern was determined without derivatization in the unsaponifiable fractions by HTGLC/FID. ST profile was characterized by a high total amount accounting for 4.22 g/kg of total H extract, and 4.00 g/kg of total CM extract. β-Sitosterol (2.035–1.929 g/kg TL) was the main component in both extracts. The major ST found were, in order of decreasing prevalence, β-sitosterol > campesterol > stigmasterol > Δ5-avenasterol > Δ7-avenasterol > lanosterol.

Keywords: *Guizotia abyssinica* Cass.; niger seed; seed oil; neutral lipid subclasses; fatty acids; triacylglycerols; sterols

Exotic oilseeds are not considered as potential raw materials to augment the supply of edible oils. Niger (*Guizotia abyssinica* Cass.) belongs to the same botanical family as sunflower. It comprises six species (BAAGOE 1974) of which *Guizotia abyssinica* Cass. is the only one cultivated. Niger seed is the most important oil crop in Ethiopia and a minor crop in India but it is not involved in the world-wide oilseed trade. Niger seed provides 50 to 60% of Ethiopia's indigenous edible oil but only 2% of India's total oilseed production. It represents also a minor oilseed crop in some other African countries (RILEY & BELAYNEH 1989). Besides cookery, niger seed oil can be used in the manufacture of soap, paints, or as a lubricant or illuminant. The protein-rich meal which remains after oil extraction is used as a feed, manure or fuel. Regarding the fatty acid profile, niger seed oil resembles that of safflower and sunflower with its high content of linoleic acid (C18:2*n*–6) which may be up to 85% depending on the origin (RILEY & BELAYNEH 1989). In addition, the oil can contain up to 1% arachidic acid, and in special varieties up to 3% linolenic acid (BOCKISCH 1998). The fatty acid composition of niger seed has been the subject of comparative investigations. DUTTA *et al.* (1994) mentioned that, in the samples collected from different regions in Ethiopia, more than 70% of the fatty acids was linoleic acid (C18:2*n*–6). The other predominant fatty acids were palmitic (C16:0), stearic (C18:0), and oleic (C18:1*n*–9) acids in a range of 6 to 11% each. DAGNE and JONSSON (1997) found two unsaturated fatty acids [linoleic (54.3–72.8, weight percent of TL) and oleic (5.4–26.8%)], and two saturated fatty acids [palmitic (7.8-–10%), and stearic (5.5–8.1%)] which formed about 91–97% of the fatty acids present. Palmitoleic, linolenic, arachidic, eicosenoic, behenic, erucic and ligno-

ceric acids constituted about 2–3%. In consideration of the potential utilization, detailed knowledge of the composition of *Guizotia abyssinica* Cass. seed oil is of major importance. Little information, however, is available for the time being.

Triacylglycerols (TAG) are the main components of vegetable oils, and the physicochemical properties of a particular oil are estimated mainly on the ground of the abundance of different TAG molecular species (FERNÁNDEZ-MOYA *et al*. 2000). The increasing efficiency of the separation of individual TAG which can now be carried out is gradually extending the understanding of both the structural composition of oils and TAG biosynthesis. On the other side, the determination of the content and composition of sterols (ST) is used for the identification of oils, oil derivatives, and for the estimation of the oil quality (HORSTMANN & MONTAG 1987; GROB *et al*. 1990; HOMBERG 1991; ARTHO *et al*. 1993; DE-BLAS & DEL-VALLE 1996). The concentration of ST in edible oils has been reported to be little affected by the environmental factors and/or by cultivation of new breeding lines (HIRSINGER 1989; HOMBERG 1991). Furthermore, phytosterols are of interest due to their antioxidant activity and health benefits (DUTTA *et al*. 1994; RICHARDSON 1996). Recently, phytosterols have been added to vegetable oils to provide an example of a successful functional food (NTANIOS 2001). This type of products is now available as part of a healthy diet and has been scientifically proven to decrease blood LDL-cholesterol by 15% approx. (WESTSTRATE & MEIJER 1998; HENDRIKS *et al*. 1999; JONES *et al*. 2000). There is no doubt that ST will become standard ingredients for this rapidly expanding category of food.

In this work, neutral lipid (NL) subclasses as well as their fatty acid profile, TAG as a major NL subclass, and ST have been analysed. The qualitative and quantitative analysis of TAG as well as ST have been performed by applying HTGLC/FID procedures. Approximate analysis of niger (*Guizotia abyssinica* Cass.) seed oil as a new supply of edible oils was the main object of the present investigation.

MATERIALS AND METHODS

Material. Mature niger seeds (product of Ethiopia, 1999) were obtained from Alfred Galke GmbH (Gittelde, Germany). It was stored at 4°C till the extraction procedure. The following highly purified TAG were obtained from Serva (Heidelberg, Germany): tricaprin (C30:0), trilaurin (36:0), trimyristin (42:0), tripalmitin (48:0), tripalmitolein (48:3), trimargrin (51:0), tristearin (54:0), triolein (54:3), and trilinolein (54:6). 1,3-dipalmtoyl-2-oleoylgylcerol (50:1), and 1,2-dioleoyl-3-palmitoyl-rac-glycerol (52:2) were purchased from Sigma Chemical Co. (St. Louis, MO, USA). Standards used for ST characterization, i.e. β-sitosterol, stigmasterol, lanosterol, ergosterol, campesterol, Δ5-avenasterol, and Δ7-avenasterol were purchased from Supelco (Bellefonte, PA, USA). The boron trifluoride-methanol complex (BF_3, 10% solution in methanol) used for the derivatization of the fatty acids was purchased from Merck (Darmstadt, Germany). The reagents and chemicals used were of the highest purity available.

Methods

Extraction of total lipid (TL). Two solvents were tested as to their efficiency in extracting TL as well as lipid subclasses. Seed material finely ground in a mill was Soxhlet-extracted with *n*-hexane (H), while the second extraction was carried out with chloroform/methanol (CM) (2:1, v/v). Under the conditions of extraction with CM, the extracted lipids require an addition of 0.2 volume of aqueous sodium chloride solution (7.5 g/l). The resulting product was thoroughly mixed without shaking, the layers allowed to separate, and the chloroform layer was recovered. The lipid extract was collected in a flask and subsequently treated with sodium sulphate to remove traces of water. The extract was filtered and then dried on a rotary evaporator at 40°C.

Thin-layer chromatography (TLC) of neutral lipid (NL) subclasses. Approximately 30 mg of TL per g of adsorbent was fractionated on a glass column of activated (120°C for 2 h) Silica Gel 60 (35–70 mesh; Merck, Darmstadt, Germany), and this was extracted with chloroform to obtain NL. Analytical and preparative TLC separation of NL subclasses was conducted on Silica Gel 60 plates (thickness 0.25 mm; Merck, Darmstadt, Germany) activated at 120°C for 2 h immediately before use. Plates were developed with *n*-hexane/diethyl ether/acetic acid (60:40:1, v/v/v), air dried, and stained with rhodamine solution in ethanol (0.5 g/l). The bands were identified with the aid of references by comparing the bands on the same chromatogram: TAG (R_f = 0.79); free fatty acids (FFA, R_f = 0.56); monoacylglycerols (MAG, R_f = 0.14); diacylglycerols (DAG, R_f = 0.39); ST (R_f = 0.37); and sterol esters (STE, R_f = 0.95). The individual bands were sprayed with rhodamine and visualized under ultraviolet light, scraped from the plate, and recovered by extraction with 10% methanol in diethyl ether, followed by diethyl ether. The data presented are the average of three gravimetrical determinations.

Fatty acid composition of neutral lipid (NL) subclasses. The isolated NL subclasses were converted into fatty acid methyl esters (FAME) by heating with boron trifluoride-methanol according to METCALFE *et al.* (1966). FAME were identified on a Shimadzu GC-14A fitted with FID and C-R4AX chromatopac integrator (Kyoto, Japan). The flow rate of the carrier gas (helium) was 20 ml/min. A sample of 1µl was injected on a 30 m × 0.25 mm × 0.2 µm film thickness Supelco SP™-2380 (Bellefonte, PA, USA)

capillary column. The injector and FID temperature was set to 250°C. The initial column temperature was set to 100°C and further programmed to rise by 5°C/min up to 175°C, kept at 175°C for 10 min, then it was allowed to rise again by 8°C/min up to 220°C, and kept at 220°C for 10 min. To facilitate the identification, a comparison was made of the retention times of the samples with those of authentic standards run on the same column under the same conditions.

HTGLC/FID analysis of triacylglycerols (TAG). TAG were analyzed on a Mega Series high resolution gas chromatography (HRGC 4160, Carlo Erba Strumentazione, Milan, Italy) equipped with FID. A 30 m × 0.25 mm id RTX-65TG column (65% diphenyl–35% dimethylpolysiloxan, Restek GmbH, Sulzbach, Germany) was used. The initial column temperature of 260°C was kept for 5 min; then it was increased by 5°C/min until 360°C, and maintained at 360°C for 25 min. The detector and the injector were maintained at 360°C and 340°C, respectively. The carrier gas (H_2) had a flow rate of 10 ml/min (split-splitless injection was used). TAG standards were run in order to identify the sample peaks by their retention times. The retention times were automatically printed by the recording integrator (C-R4AX chromatopac, Kyoto, Japan). TAG were dissolved in dichloromethane at the amount of 10 mg/ml for each TAG, and 2 µl was then injected. TAG levels were estimated on the basis of the peak areas of the standards' known concentrations.

HTGLC/FID analysis of phytosterols (ST). The separation of the intact ST was performed after saponification of the TL without derivatization as follows.

1. Extraction of the unsaponifiable matter – About 250 mg of the sample were refluxed in the presence of a few anti-bumping granules with 5 ml ethanolic potassium hydroxide solution (60 g/l) for 60 min. The unsaponifiable matter was extracted three times with 10 ml of petroleum ether, the extracts were combined and washed three times with 10 ml of neutral ethanol/water (1:1, v/v) mixture, then dried over anhydrous sodium sulphate. The combined extract was evaporated in a rotary evaporator at 25°C under reduced pressure; the residual ether was then completely evaporated under nitrogen. The ST composition was analysed by a direct injection of unsaponifiable residues into the HTGLC/FID system observing the conditions described below.

2. HTGLC/FID analysis – GLC analyses were carried out using a Mega Series high resolution gas chromatograph (HRGC 5160, Carlo Erba Strumentazione, Milan, Italy) fitted with FID-40 detector. The following parameters were tested and found useful: GLC column: ID phase DB 5, packed with 5% phenylmethylpolysiloxan (J&W Scientific, Falsom, CA, USA), 30 m lenght, 0.25 mm id, 1.0 µm film thickness; carrier-gas (helium) flow rate 38 ml per min (split-splitless injection was used). The detector and the injector were maintained at 280°C. The oven temperature was kept constant at 310°C, and the injection volume was 2 µl. All ST homologues were eluted within 45 min, and the total analysis time was performed within 60 min to secure the elution of all ST. Quantitative analyses were performed with a Shimadzu (C-R6A Chromatopac, Kyoto, Japan) integrator.

All extractions, TLC, and HTGLC/FID runs were performed in triplicates. The mean values were calculated; the standard deviation was < 12% of the mean value.

RESULTS AND DISCUSSION

Neutral lipid (NL) subclasses and their fatty acid profile

A suitable combination of the column parameters and TLC procedures on Silica Gel was used to obtain major NL subclasses of *Guizotia abyssinica* Cass. seed oil. The

Table 1. Neutral lipid (NL) subclasses and their fatty acid composition (% of total FAME) in niger seed oil

NL subclass	H extract					CM extract				
	TAG 91.9[a]	MAG 0.49	DAG 0.73	STE 0.29	FFA 4.82	TAG 89.7	MAG 0.52	DAG 0.78	STE 0.27	FFA 6.76
C16:0	18.9	28.1	24.5	23.2	21.8	17.5	25.2	26.2	24.1	20.9
C18:0	6.57	7.00	3.77	8.10	7.26	6.15	7.42	5.06	8.77	8.07
C18:1*n*–9	15.2	17.4	19.2	20.3	18.9	16.1	18.9	15.9	18.6	16.4
C18:2*n*–6	57.1	47.2	49.2	44.0	46.2	56.7	46.8	47.9	45.2	48.1
C20:0	nd	nd	nd	nd	nd	0.39	0.65	0.01	nd	0.01
C18:3*n*–3	nd	nd	nd	nd	nd	0.26	0.02	0.30	nd	0.03
C22:0	0.52	0.10	0.30	0.50	0.84	0.59	0.02	0.05	0.30	0.09
C23:0	nd	nd	nd	nd	nd	0.23	0.09	0.38	nd	0.01
C20:5*n*–3	1.71	0.20	3.03	3.90	5.00	1.84	0.89	3.70	2.03	5.49
C24:0	nd	nd	nd	nd	nd	0.24	0.01	0.50	nd	0.90

[a] g/100g of total NL; nd = not detected; values are given as mean of three replicates

results of our investigation revealed that NL account for 97% of the total H extract and 93% of the total CM extract, respectively. The proportion of NL subclasses present in the *Guizotia abyssinica* Cass. seed oil (H, and CM extracts) as well as their fatty acid compositions are given in Table 1. As expected, TAG represented the major subclass in both extracts. Furthermore, TAG level was found to be higher (91.9% of total NL) in the H extract than in the CM extract (89.7%). On the other hand, MAG, DAG, and FFA were present in lower amounts in the TL extracted with H than in the TL extracted with CM. It is known that extraction of lipids using a nonpolar solvent such as H yields the free lipids but only a part of the polar lipids (VAN DER MEEREN *et al*. 1996; FIRESTONE & MOSSOBA 1997). Moreover, CM mixture, which is more polar and more acidic than H, may dislodge and dissolve the lipid that is tightly bound to nonpolar constituents, e.g. lipid associated inside the intracellular, and protein-rich aleurone layer. GLC/FID analysis of FAME from NL subclasses of *Guizotia abyssinica* Cass. seed oil gave the same proportions of palmitic, oleic, and linoleic esters as the main FAME. Linoleic acid (C18:2*n*–6) was the main fatty acid followed by oleic acid (C18:1*n*–9) as the second main unsaturated fatty acid. Palmitic acid (C16:0) was the major saturated fatty acid in both NL subclasses followed by stearic acid (C18:0). These three fatty acids (linoleic, oleic, and palmitic) constituted about 90% of the total FAME content in all subclasses examined. Dietary fats and oils, rich in linoleic acid, have been reported to prevent cardiovascular disorders such as coronary heart disease, atherosclerosis, as well as high blood presure. Also linoleic acid derivatives serve as structural components of the plasma membrane and as precursors of some metabolic regulatory compounds (VLES & GOTTENBOS 1989). Six minor fatty acids: arachidic (C20:0), linolenic (C18:3*n*–3), behenic (22:0), tricosanoic (C23:0), eicosapentaenoic (C20:5*n*–3), and lignoceric (C24:0), were tentatively identified in CM extract on the basis of their retention times, while behenic and eicosapentaenoic acids were identified in the oil extracted with H.

Triacylglycerols (TAG) composition

The TAG structure of *Guizotia abyssinica* Cass. seed oil, which contains high amounts of palmitic, oleic, and linoleic acid, has not been reported before. There are two main reasons for the very difficult chromatographic resolution of the highly unsaturated natural TAG mixtures: (i) the large number of species with dienoic and/or trienoic fatty acid moieties to be separapted, and (ii) the wide range of proportions of the TAG. Because of this, the chromatographic conditions established for the resolution of the model mixtures are usually inappropriate for natural samples, in spite of the same fatty acid composition. To add to the difficulties, the quantities of the TAG classes may vary within broad limits (ROUMYANA *et al.* 1996). The separation of TAG species by HTGLC/FID avoids the problem of the solubility of saturated TAG in some HPLC solvents. More over, this method exhibits reasonably good sensitivity and distribution of the chromatographic peaks (FERNÁNDEZ-MOYA *et al*. 2000). Unfortunately, FID detectors do not allow the characterization of the unidentified TAG for which no standards are available, and they can not differentiate between TAG species that completely overlap in the chromatogram. Sometimes, the failure to resolve the overlapped peaks can cause some TAG species to be overestimated while others remain unidentified. *Guizotia abyssinica* Cass. seed oil contains saturated, monoenoic, and dienoic fatty acids. These may combine to yield all theoretical TAG molecular species, containing no one to six double bonds. With HTGLC/FID and H_2 carrier gas, the actual TAG molecular species of *Guizotia abyssinica* Cass. seed oil were separated. Most of the TAG molecular species were identified on the basis of a previous analysis of the standard TAG. HTGLC/FID of the total TAG (Table 2 and Fig. 1) showed that TAG of even carbon numbers 16 and 18 were present in six TAG molecular species. As expected, the major peaks occured at C54:6, and C54:3 corresponding to trilinolein and triolein. However, an unidentified peak (a) was detected in a high level (15.3% in CM extract and 19.1% in H extract), respectively. This peak, as judged by its retention time (35.5 min), must contain a long-chain fatty acid (linoleic acid) in its molecule. It can be expected to represent dilinoleoyl oleoyl glycerol (C54:5). HTGLC/FID of the 0 double bond fraction indicated that its composition resembles that of the TL except that C48:0 peak was reduced in size. This could, of course, be expected if oleic

Table 2. Triacylglycerol (TAG) composition (% of total TAG) of *Guizotia abyssinica* Cass. seed oil

IN[a]	CN:DB[b]	R_t[c] (min)	H extract	CM extract
1	30:0	9	nd	nd
2	36:0	16	nd	nd
3	42:0	21	nd	nd
4	48:0	26	9.80	8.50
5	48:3	27	nd	nd
6	50:1	28	13.5	12.8
7	51:0	29	nd	nd
8	52:2	31	10.8	11.2
9	54:0	33	4.50	3.70
10	54:3	35	20.4	22.3
11	54:6	36	21.9	26.2

[a]IN= identification number; [b]CN:DB = carbon number: double bonds; [c]R_t = retention time; nd = not detected; values are given as mean of three replicates

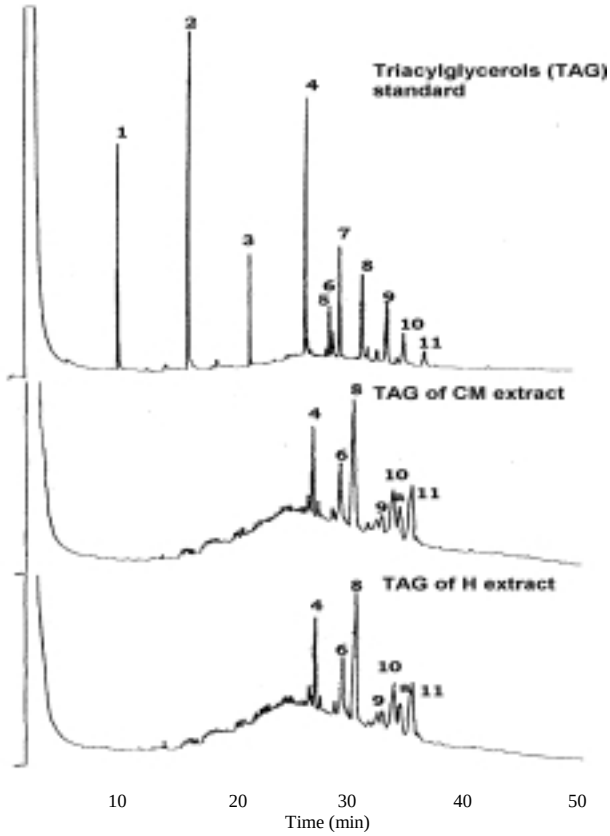
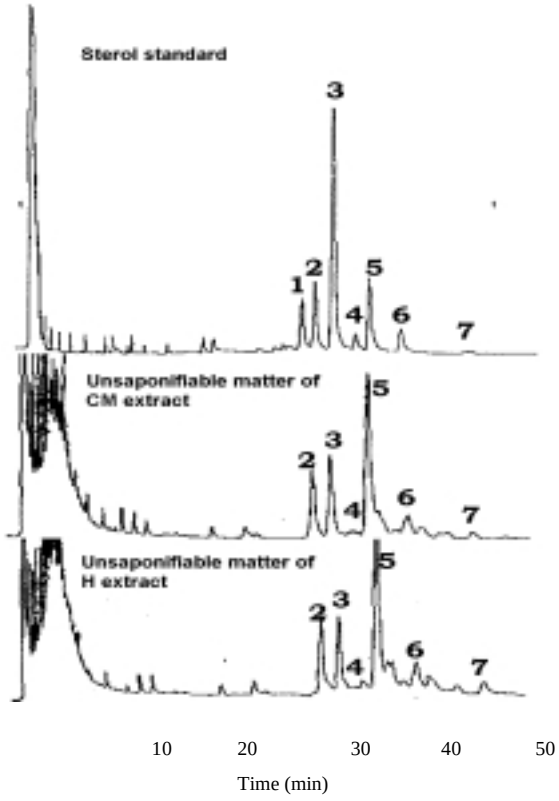


Fig. 1. HTGLC/FID separation of TAG from niger (*Guizotia abyssinica* Cass.) seed oil. Numbers were assigned to each TAG molecular species as indicated in the Table 2



1 = ergosterol; 2 = campesterol; 3 = stigmasterol; 4 = lanosterol; 5 = β-sitosterol; 6 = Δ5-avenasterol; 7 = Δ7-avenasterol

Fig. 2. HTGLC/FID separation of intact sterols from niger seed oil by direct injection of unsaponifiable residues into the GLC system without derivatization

and linoleic acids were present as dipalmitoyl oleoyl glycerol (C50:1) or dioleoyl palmitoyl glycerol, and/or palmitoyl stearoyl linoleoyl glycerol (C52:2).

Table 3. Sterol pattern (g/kg TL) of niger (*Guizotia abyssinica* Cass.) seed oil

Compound	R_t[a] (min)	H extract	CM extract
Ergosterol	27	nd[b]	nd
Campesterol	29	0.713	0.677
Stigmasterol	31	0.667	0.646
Lanosterol	33	0.113	0.105
β-Sitosterol	35	2.035	1.929
Δ5-Avenasterol	38	0.530	0.488
Δ7-Avenasterol	44	0.164	0.156
Total sterols	–	4.222	4.001

[a]R_t = retention time; nd = not detected

Sterols (ST) composition

The analysis of ST provides a powerful tool for the quality control of vegetable oils and for the detection of oil and mixtures not recognized by the fatty acids profile. Table 3 and Fig. 2 show the composition of phytosterol fractions analysed by HTGLC/FID in the *Guizotia abyssinica* Cass. seed oil extracted with H and CM. The common phytosterols, β-sitosterol, campesterol, stigmasterol, and Δ5-avenasterol were the major components. The ST pattern was characterized by a comparably high amount of total ST, which made up ca. 0.42% of total H extract, and 0.40% of CM extract, respectively. In both samples, the major ST found were, in the order of the decreasing prevalence, β-sitosterol > campesterol > stigmasterol > Δ5-avenasterol > Δ7-avenasterol > lanosterol. The major component was β-sitosterol constituting about 48% of ST content. Campesterol and stigmasterol were detected at approximately equal amounts in both samples and formed 17% and 16% of the total ST, respectively. Moreover, D5-avenasterol was present at the amount of ca. 12.2–12.5%. β-sitosterol, campesterol, stig-

masterol, and Δ5-avenasterol represented together ca. 90% of ST content. Small amounts of Δ7-avenasterol (3.8–3.9%) and lanosterol (2.6–2.7%) were identified in the analysed samples. The previous data on *Guizotia abyssinica* Cass. seed oil ST showed a rather similar pattern in that β-sitosterol was the most predominant (43% of total ST), followed by campesterol and stigmasterol. Comparing to *Guizotia abyssinica* Cass. seed oil, there are numerous published data on ST of some other oils of the compositae family, e.g., sunflower, and safflower. These oils had higher β-sitosterol content in the range of 50–75% of the total ST (DUTTA *et al*. 1994). The comparison of the composition of free ST in both extracts reveals remarkable similarities, suggesting a homogenous pattern of ST.

Conclusion

On the ground of this investigation on niger (*Guizotia abyssinica* Cass.) seed oil, it can be concluded that HTGLC/FID is a flexible analytical system, which allows to obtain valuable information about the structure of seed oil. TAG molecular species as well as ST could be separated into their individual components using the parameters described. The high linoleic acid content in all NL subclasses makes the oil of *Guizotia abyssinica* Cass. seed nutritionally valuable. It is also useful to mention that the solvents used in the extraction of the oil play an important role in the content and composition of the lipid classes recovered. *Guizotia abyssinica* Cass. seed oil is a good source of phytosterols which were found in the amount of 4.0–4.2 g/kg of the total seed oil. β-Sitosterol, campesterol, stigmasterol, and D5-avenasterol comprise together about 90% of total ST content, while β-sitosterol alone constitutes a half of the ST content. Niger (*Guizotia abyssinica* Cass.) seed could be nutritionally considered as a new non-conventional supply of seed oils.

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Souhrn

RAMADAN M.F., MÖRSEL J.-T. (2002): **Složení neutrálních lipidů v semenech ramtily habešské** (*Guizotia abyssinica* Cass.). Czech J. Food Sci., **20**: 98–104.

Provedli extrakci semen ramtily habešské (G*uizotia abyssinica* Cass.) hexanem (H) a směsí chloroform-metanol (CM) (2 : 1 v/v) a stanovovali vliv rozpouštědel na množství a složení získaných lipidů. Množství celkových lipidů (TL) extrahovaných pomocí H činilo 29,6 % z hmotnosti semen, zatímco při extrakci CM se rovnalo 49,90 %. K frakcionaci hlavních neutrálních lipidů (NL) jsme použili sloupcovou chromatografii a chromatografii v tenké vrstvě na silikagelu. Vyhodnotili jsme složení mastných kyselin v NL, molekulární druhy triacylglycerolů (TAG) a obsah sterolů (ST). Množství NL bylo vyšší (97% z TL) v extraktu H než v extraktu CM (93 % z TL). TAG tvořily převlážně NL (89,7– 91,9 % z celkových NL). Jako hlavní mastnou kyselinu jsme zjistili kyselinu linolovou (C18:2n–6), dále následovala hlavní nenasycená mastná kyselina kyselina olejová (C18:1n–9); hlavní nasycenou mastnou kyselinou byla kyselina palmitová (C16:0). Pomocí vysokoteplotní plynové-kapalinové chromatografie s použitím plamenového ionizačního detektoru (HTGLC/FID) a H_2 jako nosiče plynu jsme provedli separaci aktuálních druhů TAG podle počtu jejich uhlíků. Hlavní maxima nastala při C54:6 a C54:3, což odpovídalo trilinoleinu a trioleinu. Kromě toho jsme zjistili vysokou hladinu molekulárního druhu TAG, který měl obsahovat dvě molekuly kyseliny linolové (C54:5). Spektrum fytosterolů jsme zjišťovali pomocí HTGLC/FID bez derivatizace v nezmýdelnitelných frakcích. Pro ST bylo charakteristické celkové vysoké množství, které činilo 4,22 g/kg celkového extraktu H a 4,0 g/kg celkového extraktu CM. Hlavní složku v obou extraktech představoval β-sitosterol (2,035–1,929 g/kg TL). Převládajícími ST byly v pořadí klesající prevalence β-sitosterol > kampesterol > stigmasterol > Δ5-avenasterol > Δ7-avenasterol > lanosterol.

Klíčová slova: *Guizotia abyssinica* Cass.; semena ramtily; olej semen; podtřídy neutrálních lipidů; triacylglyceroly; steroly

Corresponding author:

MOHAMED FAWZY RAMADAN HASSANIEN, M.Sc., Institute of Food Chemistry, Technical University of Berlin, Gustav-Meyer-Allee 25, TIB 4/3-1, D-13355 Berlin, Germany

tel.: + 49 30 31 47 28 13, fax: + 49 30 31 47 28 23, e-mail: hassanienmohamed@hotmail.com