Egypt. J. Agric. Res. , 75 (3), 1997.



# CHARACTERISTICS AND FATTY ACID CONTENT OF OILS of SOME SEEDS OF MALVACEAE

**AWATIF I.I.[1] AND H.M.A. MOHAMED [2]**

*1 Oil and fat Res. Lab., Food. Techn. Res. Inst., Agri. Res. Centre, Giza, Egypt .*

*2 Dept. of Food Science, Fac. of Agric. Minia Univ., El-Minia Egypt .*

(Manuscript received 25 December 1996)

***Abstract***

The fatty components of several seeds belonging to family malvaceae were studied. Three seed varieties of okra (*Hibiscus esculentas* var. Pusa Swani, Baladi and Romi), Roselle seeds (*Hibiscus Sabdariffa*), Egyptian Mallow seeds (*Malva Parviflora*) and Cottonseeds (*Gossypium Barbadense* var. Giza 75) were investigated for their oil contents, physico-chemical properties of oils, fatty acid composition, cyclopropeniod fatty acids, phospholipids, gossypol and unsaponifiable matter constituents. The results indicated that oil content ranged from 15.3% for okra seed (var. Pusa) to 21.5% for roselle seed. The fatty acid profiles are generally consistent with the fatty acid pattern found in cottonseed oil but with a wide range of prortions. The main fatty acids were palmitic (15.27 - 34.33%), oleic (21.86 -38.27%) and linoleic (23.63 - 49.75%). Differences were observed in oleic/linoleic ratio. All the oils gave red colours with Halphen reagent(indication of cyclopropenoed). The unsaponifiable matter of the studied seed oils varied from 0.98 to 1.16%. The hydrocarbons fraction constituted from 8.05% (roselle seed oil) to 25.33% (okra seed oil va. Pusa) of the unsaponifiable matters. Squalene compound was the major hydrocabon (2.82 - 10.96%). The sterol fraction constituted the major component in the unsaponifiables of all oil samples. B-sitosterol was found to be predominant (65.23 - 84.02%). Crude cottonseed oil was more resistant to oxidation deterioration due to the presence of gossypol which act as natural antioxidant and also the synergistic effect of phospholipids. Because of the allied refined colour, the absence of gossypol, the reduced level of cyclopropenoid fatty acids beside the highly C18 unsaturated fatty acid contents, the results suggest that okra seed oil could be considered as a new additive source for vegetable oil.

## INTRODUCTION

The continuous increase in population especially in developing countries as well as the increase in the demand for oils and their products, necessitate the investigation of some other new and noncoventional additive sources that may participate in solving the oils shortage problem. The plant kingdom globally provides us with a large variety of unexploited oils and fats which could be developed commercialy.

The family Malvaceae consists of about 50 genera and 1000 species distributed throughout the world (Purseglove, 1976). Two genera are of major economic importance : *Gossypium* which involves several species of cotton and *Hibiscus*, which a part from its ornamental species provides a significant fibre crop and a tropical vegetable. The family Malvacae includes the most important oil production plant, cottonseed. Cottonseed oil (*Gossypium* spp.) accounts for the second largest production of oil of all oilseed crops (USDA, 1988).

The high oil contents in several Malvaceae seed varieties attracted the attention of many investigators (Vakulin 1935; Lwey 1947; Jacky 1958). They suggested that the seeds of several *Hibiscus* varieties could be used as sources of oils for their high oil yields which ranged from 17 to 23.8%. Many of these oils were almost similar to cottonseed oil. Subbaram *et al.* (1964) examined the lipid of four seeds of Malvaceae : kenaf, okra, Roselle and hollyhock. They found a content of 3 to 6 % epoxy oleic acid and a linoleic acid figure remarkably close to 38%, the balance was made up of palmitic acid (19-35%) and oleic acid (22-37%). Ahmad *et al.* (1979) mentioned that the seed oil of Roselle contains 35.2% palmitic acid, 34% oleic acid, 14.6% linoleic acid, beside 4.5% of epoxy oleic acid. Al-Wandawi (1983) studied the fatty acid composition of two okra cultivars. He reported that okra seed oil was akin to other high oleic acid oils.

The seed oil of Malvaceae is known to contain glycerides of cyclopropene (malvalic and sterculic), cyclopropane (dihydromalvalic and dihydrosterculic) and epoxy conjugated di-en-ol acids (Ahmad *et al.*, 1984). The cyclopropene acids inhibit the biodesaturation of stearic acid to oleic acid and this leads to several adverse biochemical effects. However, such acids are largely deactivated or removed from the oil by hydrogenation or during deodorization at 230-235$^{o}$C (Gaydou and Ramanelina, 1984).

The component triacyl glycerols of six seed oils of Malvaceae (Egyptian cotton, okra, kenaf, roselle and hollyhock) were investigated by Fiad (1991a). The oils were found to contain triacyl gycerols belonging to tri-saturated (1.0-2.1%), di-

saturated - monounsaturated (12.3-20.9%), monosaturated-diunsaturated (30.1-44.2%) and triunsaturated (30.1 - 44.2%) types of triacyl glycerols. Furthermore, Fiad (1991 b) analysed the phospholipid contents of the same six seed oils of Malvaceae and mentioned that total phospholipids ranged from 1.2% for okra seed oil to 1.9% for cottonseed oil. The common phosphatides were cephalins, lecithin and some of their lysoforms. Rao (1991) determined the cyclopropenoid fatty acids of six seed oils from Malvaceae. He found that they contained cyclopropene fatty acids, malvalic and sterculic in the range of 1-4.4% and 0.1-1.5%, respectively. Dihydrosterculic acid was present in small quantities (trace 2.1%).

This study was designed to assess the status of the oils extracted from seed samples of Malvaceae family grown under Egyptian environment in terms of lipid contents, their composition of fatty acids, phospholipids, antinutritional (gossypol and cyclopropenoid fatty acids) and unsaponifiable fractions which can help in finding available seeds for oil production.

## MATERIALS AND METHODS

### Materials

Okra seed (*Hibiscus esculentas* var. Pusa Swani) was obtained from the research field of the Horticulture Department, Faculty of Agriculture, Minia University. Two other different varieties of okra (Baladi and Romi), and seeds of roselle (*Hibiscus Sabdariffa*) and Egyptian mallow (*Malva Parviflora*) were purchased from commercial seed suppliers. Cottonseeds (*Gossypium Barbadense* var. Giza 75) was obtained from the Agricultural Research Center, Ministry of Agriculture, Egypt .

### Oil extraction

The seeds were ground in a disentegrator. The ground seeds were extracted with n-hexane for 48 hours then filtered. This process was repeated 3 times using fresh solvent each time to extract most of the oils from the ground seeds. The miscella was collected, mixed and evaporated at 60$^{o}$C under vacuum, then the extracted oils were dried over anhydrous sodium sulphate.

### Analytical methods

The crude oil contents were determined in triplicate by Soxhlet procedure according to the AOAC method (1980). For the Physico-chemical studies, The AOCS methods (1978) were used to determine saponification value (Cd 3-25), refractive

index (Cc 7-25), iodine value (Cd 1-25), Acid value (Cd 3a-63), Peroxide value (Cd 8-53), Phosphorus (Ca 12-55), Lovibond colour (Cc 13b-45) and Halphen test (Cb 1-25). The total gossypol contents of the crude oils was determined before and after its reaction with P-anisidine by the difference in its spectrophotometric absorbance at 440 nm of duplicate aliquots of the filtrate according to the AOCS method Ca 13-56. Phospholipid contents in oils were calculated by multiplying phosphorus content by a conversion factor of 5 (Weihrauch and Young, 1983). All analysis was performed in triplicate.

## Gas liquid chromatography analysis of fatty acids

The fatty acids methyl esters were prepared using benzene : methanol : concentrated sulfuric acid (10 : 86 : 4) and methylation was carried out for one hour at 80-90$^{o}$C according to Stahl, (1967). The composition of fatty acids were achieved by Gas liquid chromatography analysis using PYE Unicam model PV 4550 capillary Gas chromatography fitted with flame ionization detector, the column (1.5 m x 4 mm) packed with diatomite C (100-120 mesh) and coated with 10% polyethylene glycol adipate (PEGA). The column oven temperature was programmed at 8oC/min from 70$^{o}$C to 190$^{o}$C then isothermally at this temperature for 20 min and nitrogen flow rate was 30 ml/min. Detector, injection temperatures, hydrogen and air flow rates and chart speed were 300$^{o}$C, 250$^{o}$C, 33 ml/min, 330 ml/min, respectively. The presented fatty acids were identified and calculated according to an authentic sample of fatty acids chromatographed under the same conditions.

## Gas liquid chromatography analysis of unsaponifiable matters

The unsaponifiable matters were extracted after saponification of oil at room temperature according to the method outlined by Mordret (1968). The unsaponifiables constituents of the seed lipids were analysed directly using the Unicam capillary Gas chromatography PV 4550 fitted with flame ionization detector on a coiled glass column (2.8 m x 4 mm) packed with diatomite C (100-120 mesh) and coated with 1% OV-17 as stationary phase. The oven temperature was programmed at 10$^{o}$C/min from 70$^{o}$C to 270$^{o}$C, then isothermally at this temperature for 15 min. and nitrogen flow rate was 30 ml/min. Detector, injection temperatures, hydrogen and air flow rates and chart speed were 300$^{o}$C, 250$^{o}$C, 33 ml/min, 330 ml/min and 2 cm/min, respectively. The various fractions separted were identified and calculated according to an authentic sample of hydrocarbons and sterols chromatographed under the same conditions.

### Measurement of stability.

The oven test method suggested by Thompson (1966) was adopted for checking the stability of oils. Oil samples (50 gm) were placed in 250 ml beakers covered with watch glasses and incubated at 63 ± 1°C until rancidity took place. Rancidity was periodically assessed every 48 hours through measuring the peroxide value.

## RESULTS AND DISCUSSION

The oil contents and their characteristics are given in Table 1. It should be noticed that the seeds when extracted with hexane gave an appreciable percentages of oils that ranged from 15.3% for okra seed var. Pusa to 21.5% for roselle seed. The high oil content for Malvaceae seeds is in good agreement with that indicated by many investigators (Subbaram *et al.*, 1964, Fiad 1991; Xiao *et al.*, 1993; El-Adawy, 1994). The saponification value of the investigated seed oils were in the range of 190-198 refers to the high molecular weight of the fatty acids of their triglycerids. The iodine value varied from 92.87 to 102.64 suggesting that these oils are categorized as semidrying oils. In addition, the refractive index of the resultant crude oils were in the range of 1.4679-1.486. Results were generally in accordance with the literature values (Ahmad *et al.*, 1979; Badami *et al.*, 1982; Pandi and Suri 1982; Rao *et al* ., 1992).

Results in Table 1 indicate that the oil seeds of roselle and Egyptian mallow had the highest acid values, 10.15 and 6.58, respectively, whereas the rest of the seed had acid values in the range of 4.06 to 5.22. This may reflect some degree of hydrolysis caused by the hydrolytic enzymes during the storage of the seeds. Then crude oils should be treated with sodium hydroxide, washed, filtered and dried in the usual maner to overcome the problem of high acidity. Furthermore, the unsaponifiable matter of the investigated seed oils varied from 0.98-11.16%. Similar results were reported by Diab (1968) for the unsaponifiable matters of roselle seed oil and by Abdel-Nabey *et al.* (1991) for those of cottonseed oil.

Results in Table 1 also revealed that crude cottonseed oil included 2.3% of gossypol. Gossypol is a yellow phenolic dimeric sesquiterpene pigment considered as an antinutrient because it is toxic to monogastric animals (Pons, 1977). This compound was found in okra, roselle and mallow seed oils only as traces. Likewise, crude cottonseed oil was found to possess dark colour. This color was correlated

Table 1. Oil contents and physico-chemical properties* of the investigated seed oils of Malvaceae.

| Physico-chemical properties | Okra seed oil (var. Puza) | Okra seed oil (var. Baladi) | Okra seed oil (var. Romi) | Roselle seed oil | Okra seed oil (var. Romi) | Okra seed oil (var. Romi) |
|---|---|---|---|---|---|---|
| Oil content % | 15.3 | 15.7 | 17.8 | 21.5 | 17.8 | 19.7 |
| Saponification value | 190.05 | 192.13 | 195.0 | 191.5 | 194.08 | 198.0 |
| Iodine value | 92.87 | 94.97 | 93.50 | 97.15 | 102.64 | 99.89 |
| Refractive index | 1.4679 | 1.4681 | 1.4682 | 1.4683 | 1.4685 | 1.4686 |
| Acid value | 4.06 | 4.95 | 5.22 | 10.15 | 6.58 | 4.55 |
| Unsaponifiable matter % | 1.04 | 0.98 | 1.07 | 0.98 | 1.09 | 1.16 |
| Total gossypol % | Trace** | Trace** | Trace** | Trace** | Trace** | 2.3 |
| Total Lovibond colour (Y ± 10 R) | 60 | 58 | 56 | 78 | 56s | 230 |

* Mean of triplicate determinations

** Trace mean that < 0.1 %

with the oxidation of gossypol and related pigments (Norris, 1979). On the other-hand, the oils of the three investigated varieties of okra and Egyptian mallow seeds were slightly coloured than that of roselle seed and had similar colour characteristics to those reported for refined oils (Mukhopabhyay *et al.*, 1991).

The relative concentrations of fatty acids composition are shown in Table 2. It is clear that the component fatty acids in the investigated seed oils were similar but with a wide range of proportions. The main fatty acids are palmitic (15.27 - 34.33%), oleic (21.86-38.27%), and linoleic (23.63-49.75%). Therefore, Malvaceae seed oils is tipical of the oleic-linoleic group of vegetable oils since those two acids comprise together an average of 70.68%. Differences were observed in oleic/ linoleic ratio. The data indicate that the relative concentration of oleic acid was roughly equal to linoleic acid in both of okra seed var. Balady and roselle seed oils, while the latest acid was the major component in okra seed oil var. Romi (32.91%), Egyptian mallow seed oil (49.75%) as well as in cottonseed oil (47.52%). This relationship is in agreement with the fact that oleic acid is desaturated to linoleic acid by the desaturated enzymes in the tissues (Diab, 1968). On the other hand, okra seed var. Pusa due to its high oleic and palmitic acid contents (33.48%, 34.33% respectively) may be more attractive for potential food uses where shelf stability and longer frying life are important. The fatty acid composition in the present study correlates with the previously published data (Subbaram *et al.*, 1964; Ahmad *et al.*, 1979; Fiad; 1991 a ; Rao, 1991) and the only deviation is in the oleic /linoleic ratio. However, such variations could be attributed to varietal effect and other environmental conditions.

Because of the co-occurrence of cyclopropene and epoxy acids in the seed oils of Malvacea, it was considered worthwhile to examine the above seed oils by the Halpphen test. All the oils gave characteristic red colours with Halphen reagent. In order to compare the relative amounts of cyclopropene fatty acids, the degree of the red colours formed after the reaction with the halphen reagent was measured by the Lovibond red unit (Figure 1). It is obvious that the level of cyclopropenoid fatty acids in the oil seeds of roselle and Egyptian mallow equalise 3 and 2.2 times respectively of those presented in cottonseed oil. Therefore, it can be concluded that *H.sabdariffa* and *M.parviflora* seed oils can not be utilised for edible purpose due to the carcinogenic properties of the cyclopropene fatty acids. On the other hand the amount of these cyclic acids in okra seed oils var. Pusa, Balady and Romi approaches only 0.30, 0.55 and 0.63 times, respectively of their counterparts in cottonseed oil. Al-Wandawi (1983) detected the Halphen positive cyclopropenoid compounds in two

Table 2. The relative concentration of fatty acids of the investigated seed oils of Malvaceae.

| Relative concentration of fatty acids | Okra oil (var. Puza) | Okra oil (var. Baladi) | Okra oil (var. Romi) | Roselle oil | Mallow oil | Cotton oil |
|---|---|---|---|---|---|---|
| Myristic (C14:0) | 0.59 | 0.35 | 0.29 | 0.21 | 0.54 | 1.29 |
| Palmitic (C16:0) | 34.33 | 22.45 | 32.36 | 19.02 | 15.27 | 22.98 |
| stearic (C18:0) | 4.69 | 1.68 | 3.50 | 1.80 | 2.05 | 3.10 |
| Oleic (C18:1 n-9 ) | 33.48 | 36.78 | 28.00 | 38.27 | 31.24 | 21.86 |
| Linoleic (C18:2 n-6) | 23.63 | 35.50 | 32.91 | 38.06 | 49.75 | 47.52 |
| Linoleic (C18:3 n-3) | 0.97 | 0.40 | 0.66 | 0.50 | 0.20 | 0.45 |
| Others | 2.31 | 2.84 | 2.28 | 2.14 | 0.95 | 1.92 |
| Total | 39.61 | 24.48 | 36.15 | 21.03 | 17.86 | 27.36 |
| Total saturated | 60.39 | 75.52 | 63.85 | 78.97 | 82.14 | 72.63 |
| Total unsaturated | 1.52 | 3.08 | 1.77 | 3.75 | 4.60 | 2.64 |
| Total unsaturated/total saturated | 1.42 | 1.06 | 0.85 | 1.01 | 0.63 | 0.46 |

Table 3. The relative concentration of fatty acids of the investigated seed oils of Malvaceae.

| Relative concentration of fatty acids | RRT* | Okra oil (var. Pusa) | Okra oil (var. Baladi) | Okra oil (var. Romi) | Roselle oil | Mallow oil | Cotton oil |
|---|---|---|---|---|---|---|---|
| Dodecane (C12) | 0.143 | 0.15 | - | 0.94 | 0.07 | - | 0.28 |
| Tetradecane (C14) | 0.185 | - | - | 0.77 | - | - | 0.19 |
| Hexadecane (C16) | 0.234 | 0.39 | - | 0.25 | - | 0.08 | 0.09 |
| Octadecane (C18) | 0.292 | 0.789 | 0.23 | 0.83 | 0.04 | - | 0.16 |
| Eicosane (C20) | 0.401 | 0.19 | 0.12 | 0.15 | 0.15 | 0.03 | 0.50 |
| Docosane (C22) | 0.525 | - | 0.26 | 0.07 | 0.06 | 0.05 | 0.20 |
| Tricosane (C24) | 0.605 | 3.20 | 4.31 | 3.13 | 0.35 | 0.67 | 8.77 |
| Tetracosane (C26) | 0.643 | 2.16 | 1.47 | 1.33 | 0.37 | - | 0.89 |
| Petacosane (C28) | 0.708 | 0.34 | 0.50 | 0.13 | 0.13 | - | 0.33 |
| Squalene | 0.771 | 10.96 | 6.71 | 9.94 | 2.82 | 3.84 | 4.67 |
| Triacontane (C30) | 0.791 | 3.04 | 2.56 | - | 2.57 | 3.65 | - |
| Others | - | 4.12 | 3.46 | 3.98 | 1.49 | 1.15 | 2.56 |
| Total Hydrocarbons | - | 25.33 | 19.62 | 21.52 | 8.05 | 9.47 | 18.64 |

* Relative retention time to β-sitosterol (19.87 min) which was taken as 1.00

okra cultivars in amounts equal to fifth of that presented in crude cotton oil.

Data in Figure 2 show the total phospholipid content of the investigated seed oils. Cottonseed oil contained the highest value (1230 mg/kg oil) followed by okra seed oil var. Romi (1140 mg/kg oil), whereas, okra seed oil var. Pusa contained the least amount (330 mg/kg oil). In this resprect, Fiad (1991 b) mentioned that the average phospholipid contents in some seed oils of Malvaceae obtained by Folch extraction was 1550 mg/kg oil.

The hydrocarbons fraction of the unsaponifiable matters ranged from 8.05% (roselle seed oil) to 25.33% (okra seed oil va. Pusa) (Table 3). It is evident that squalene compound was the major hydrocabon (2.82-10.96%). Results indicated also that cottonseed oil contained more Tricosane (C24) hydrocarbon (8.77%) than the rest of the seeds, while Egyptian mallow seed oil contained the greatest amount of Triacontane (C30) hydrocarbon (3.65%). In addition, the highest percentage of Tetracosane (C26) hydrocarbon was found in okra seed oil var. Pusa (2.16 %). The other hydrocarbon compounds were present only in minor amounts.

Table4. The relative concentration of the sterols in the unsaponifiable matters of the investiated seed oils of Malvaceae.

| Sterols | RRT* | Okra oil (var. Pusa) | Okra oil (var. Baladi) | Okra oil (var. Romi) | Roselle oil | Mallow oil | Cotton oil |
|---|---|---|---|---|---|---|---|
| Campesterol | 0.851 | 5.46 | 6.54 | 6.77 | 5.31 | 5.08 | 5.91 |
| Stigmasterol | 0.905 | 3.98 | 1.57 | 2.51 | 2.62 | 1.77 | 3.36 |
| β-sitosterol | 1.00 | 65.23 | 72.27 | 69.20 | 84.02 | 83.68 | 72.09 |
| Total sterols | --- | 74.67 | 80.38 | 78.48 | 91.95 | 90.53 | 81.36 |
| β-sitosterol/campesterol | --- | 11.95 | 11.05 | 10.22 | 15.82 | 16.47 | 12.20 |

* Relative retention time to β-sitosterol (19.87 min) taken as 1.00.

The sterol fraction constituted the major component in the unsaponifiables of all oil samples (Table 4). Roselle seed oil contained the highest amount of sterols (91.95%) followed by Egyptian mallow seed oil (90.53%), while the unsaponifiables of okra seed oil (Var. Pusa) showed the lowest content of total sterols (74.67%). It is quite obvious that B-sitosterol was found to be predominant in all samples (65.23-84.02%), besides containing campesterol in the 5.08-6.77% range and stigmasterol at the range of 1.57 to 3.98%. The role of phytosterols in lowering the

plasma cholesterol level was described (Swell *et al.*, 1954). Moreover, B-sitosterol/campesterol ratio could be used as an index to identify the purity of any oil besides the necessary confirmatory tests (EL-Hinnawy *et al.*, 1983). In the present investigation, B-sitosterol/campesterol ratio was calculated and ranged from 11.05 for okra seed oil (var. Baladi) to 16.47 for Egyptian mallow seed oil. It is worthy to indicate that the B-sitosterol/campesterol ratio of okra seed oil var. Pusa is quite similar to that of cottonseed oil. In this respect, Abdel-Naby *et al.* (1991) showed that the sterol contents of 14 crude cottonseed samples extracted from different cultivars varied between 42.45% and 64.25% which was mainly B-sitosterol (76-87%) and campesterol (5.4-14.5%) and the ratio between B-sitosterol and campesterol varied from 10.2 to 15.4. Such results were also mentioned by Mohamed *et al.* (1995) indicating that the major sterols in kenaf seed oil (*Hibiscus cannabinus* L.) were B-sitosterol (72.3% of the total sterols), campesterol (9.9%) and stigmasterol (6.07%).

Table 5. Induction periods of the investigated seed oils of Malvaceae as determined by the oven test at 63 ± 1°C.

| Source of oil | Source of oil (Days) |
|---|---|
| Okra seed Var. Pusa | 13 |
| Okra seed var. Baladi | 12 |
| Okra seed var. Romi | 13 |
| Roselle seed | 10 |
| Mallow seed | 9 |
| Cottonseed | 15 |

Figure 3 (a,b) illustrated the storage stability of the various investigated seed oils compared to that of cottonseed oil. The results revealed that crude cottonseed oil was more resistant to oxidation deterioration and had an induction period of 15 days (Table 5). This resistance was attributed to the presence of gossypol which act as natural antioxidant and also the synergistic effect of the phospholipids (Hudson and Ghavami, 1984). Results are in a good agreement with those reported by Synder *et al.* (1985). Results indicated also that the oil of the three varieties of okra seed had moderate stability and showed induction periods varying from 12-13 days. On the otherhand, roselle seed and Egyptian mallow seed oils exhibrited oxidation more

rapidally due to their high content of C18 unsaturated fatty acid (78.97 and 82.14%, respectively).

The current study recommends the use of okra seed oil as a new additive source of vegetable oil after further biological evaluation and some refining treatments. The allied refined colour, the absence of gossypol, the reduced level of cyclopropenoid fatty acids beside the highly C18 unsaturated fatty acid contents suggest that Baladi, was relatively the most suitable variety of okra for oil production. On the ohter hand, the high contents of acid values and cyclopropenoid fatty acids in roselle and Egyptian Mallow oil seeds limit their use for edible purpose and may serve in other industrial applications. This would certainly offer a partial solution for oil difficiency in Egypt.

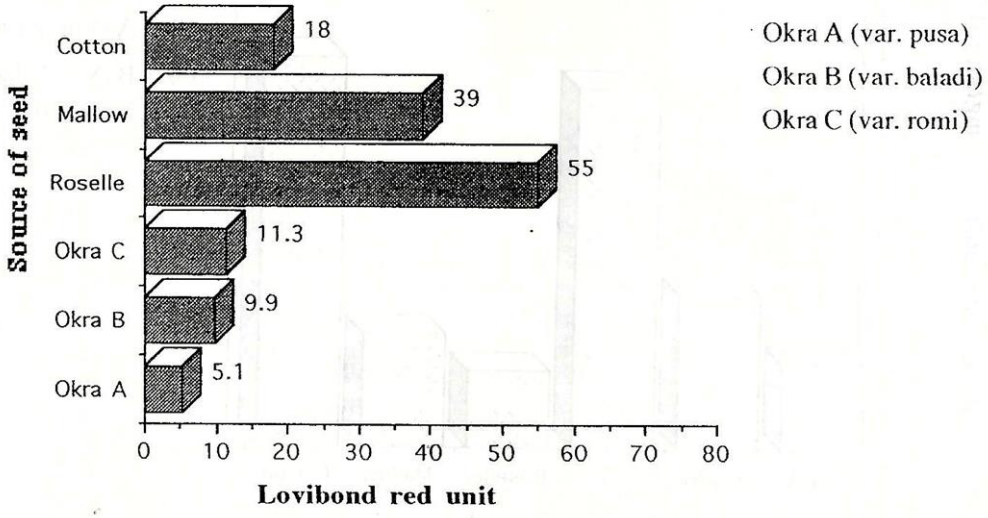


Fig 1. The degree of the red colour formed by the halphen test as indication of the amount of cyclopropene fatty acids in the oil.

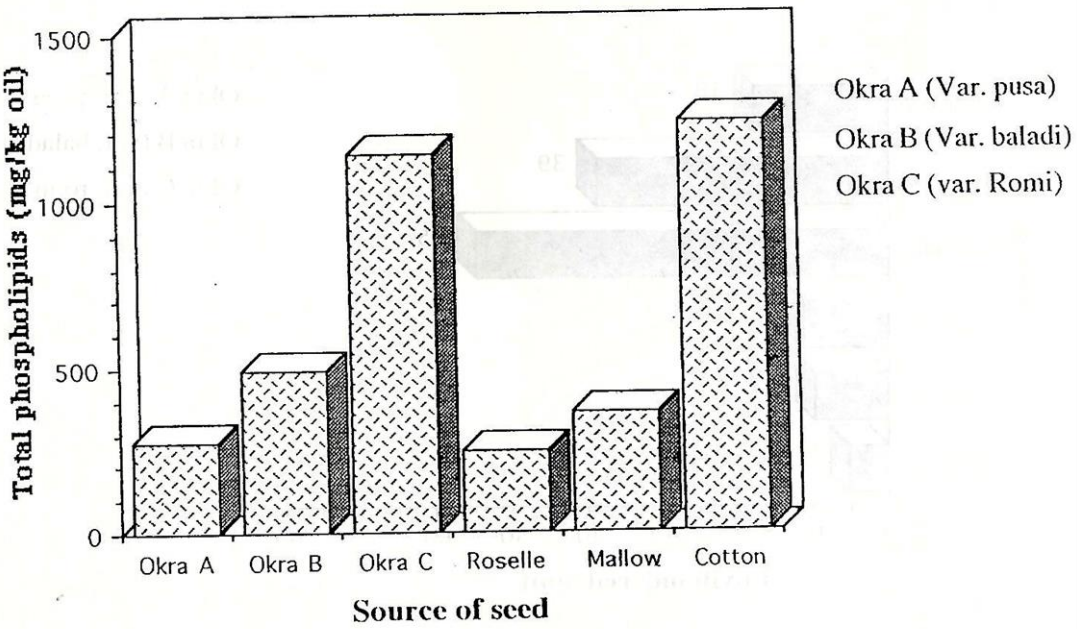


Fig 2. Total phospholipids of seed oils of Malvaceae .

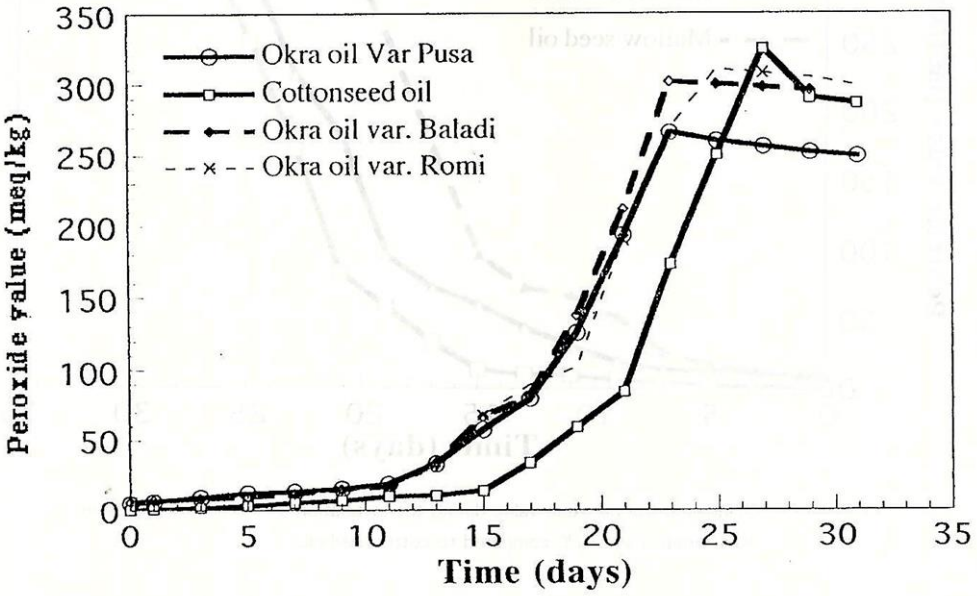


Fig. 3 a. Changes in the peroxide value during the incubation of the oils of the three okra varieties at 63 °C compared to cottonseed oil.

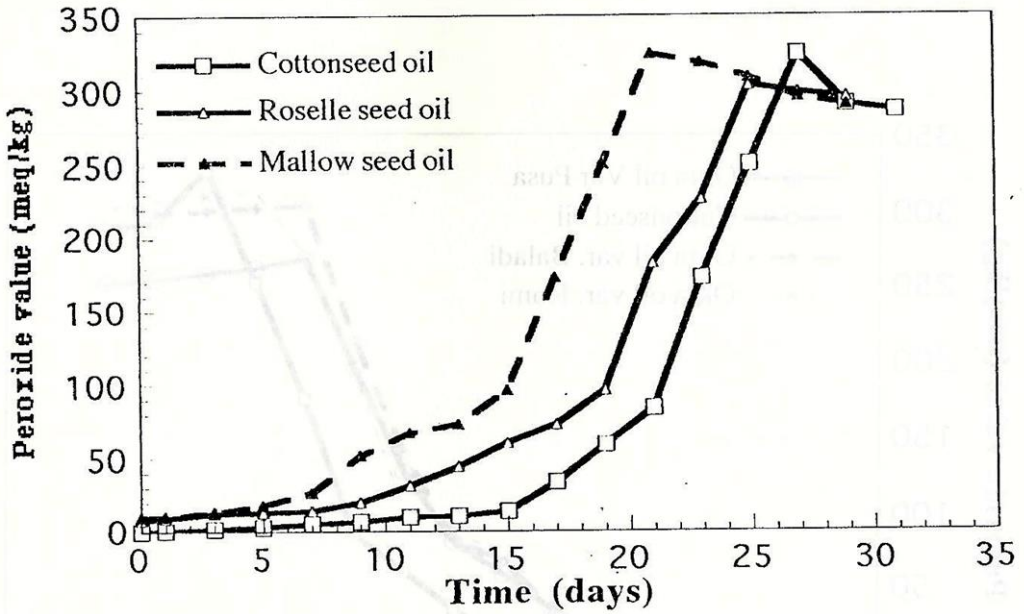


Fig. 3 b. Changes in the peroxide value during the incubation of the oils of the three okra varieties at 63 °C compared to cottonseed oil.

## REFERENCES

1. Abdel-Nabey, A.A., Shehata, A.D.Y., Ragab, M.H. and Rossel, J. B. 1991. Total Unsaponifiables, sterols and tocols of cottononseed oil from Egyptian and other varieties. Rivista-Italiana-dell-Sostanze-Grasse 68 (11) : 583-587.

2 . Ahmad, M. V., Husain, S.K., Ahmad, H.I. and Osman, S.M. 1979. Hibiscus Sabdariffa seed oil : A Re-investigation. J. Sci. Food Agri. 30 : 424-428.

3 . Ahmad, M. V., Sinha, S., Husain, S.K. and Osman, S.M. 1984. The nature of the oxygenated fatty acids present in Malva Parviflora seed oil. J. of the Sc. of Food and Agri. 35 (4) : 408-414 .

4 . Al-Wandawi, H.1983. Chemical composition of seeds of two okra cultivars. J. Agric. Food Chem 31 : 1355-1358.

5 . Badami, R.C., Alagawadi, K.R. and Shivamurthy, S.C. 1982. Cyclopropenoid acids and fatty acid content of ten varieties of Hybrid cottonseed oil. Fette Seifen Ansterichmittel 84. (7) : 278-280 .

6. Diab, M.A.M. 1968. The chemical composition of Hibiscus Sabdariffa. M. Sc. Thesis, Cairo University.

7. El-Adawy, T.A. and Khalil, A.H. 1994. Characteristics of roselle seeds as a new source of protein and lipid. J. of Agric. and Food Chem. 42 (9) : 1896 - 1900.

8. El-Hinnawy, S.E., Torki, M.A., El-Hadidy, Z.A. and Khalil A.R. 1983. Studies of the unsaponifiable matters in some vegetable oils. Annals Agric. Sci. 28 (1) : 395-415 .

9. Fiad, S. 1991 a. Component triacylglycerols of six seed of Malvaceae. J. Amer. Oil Chem. Soc. 68 (1) 23-25.

10. Fiad, S. 1991 b. Phospholipids of six seed oils of Malvaceae. J. Amer. Oil Chem. Soc. 68 (1) 26-28.

11. Gaydou, E.M. and Ramanoelina A.R.P. 1984. Cyclopropenoid fatty acids of Malvaceae seed oils by gas liquid chromatography. Fette Seifen Anstrichmittel 86 (2) : 82-84.

12. Hudson, B.J.F. and Ghavami, M. 1984. Phospholipids as antioxidant synergists for tocopherols in the autoxidation of edible oils. Lebensm. Wiss. Technol. 17 : 149.

13. Jaky, M. 1958. Oleaginous seed in Hungary. Oleagineux 13 : 149-152.

14. Lewy, M. 1947. Kenaf seed oil. J. Amer. Oil Chem. Soc. 24 : 3-5.

15. Mohamed, A. Bhardway, H. Hamama and A. Webber, C. III 1995. Chemical composition of Kenaf (Hibiscus Cannabinus L.) seed oil. Industrial Crops and Products 4 (3) : 157-165 .

16. Mordert, F. 1968. Comparison and study of methods of obtaining unsaponifiable matter. J. Crops Grass, 6 : 389-397.

17. Mukhopabhyay, Gupta P.K. and Basu, A.K. 1991. Bleaching of cottonseed and soybean oils by hydrogen generated in situ. J. Amer. Oil Chem. Soc. 68 : 791.

18. Norris, F.A. 1979. Handling, storage and grading of oils and oil-bearing materials, Ch. 7. In "Bailey's Industrial Oil and Fat products". Vol. 1, 4th ed, D.swern, ed. John Wiley and Sons, N.Y.

19. Official Methods of Analytical of Official Analytical Chemists, Association of Official Analytical Chemists, Washingtong, D.C, 1980 .

20. Official and Tentative Methods of the American oil Chemists Sociaty, 3rd edn., edited by R.O. Walker, AOCS, Champaign, IL, 1978.

21. Pandey, S.N. and Suri, L.K. 1982. Cyclopropenoid fatty acid content and iodine value of crude oils from Indian cottonseed J. Amer. Oil Chem. Soc. 59 (2) 99-101.

22. Pandey, S.N. and Subrahmanyam, V.V.V., 1987. compositional studies on cottonseed and its oil. Journal of the oil Technologists Association of India 19 (2) : 38-40.

23. Pons, W.A. 1977. Gossypol analysis : past and present. J. of A. O.A.C. 60 (2) : 252-259.

24. Purseglove, J. W. 1976. Tropical crops. Dicotyledons 1. Third ed. Longman, G. L. Longman, London, pages 333-374.

# خصائص ومحتوى الأحماض الدهنية لزيوت بعض بذور العائلة الخبازية

عواطف ابراهيم اسماعيل ١ ، هانى مصطفى على محمد٢

١ قسم بحوث الزيوت – معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية .
٢ كلية الزراعة جامعة المنيا قسم علوم الأغذية .

المكونات الدهنية لبعض البذور التابعة للعائلة الخبارية تم دراستها فى هذا البحث. استخدام فى هذه الدراسة ٣ أصناف من بذور الباميا وهى بوذا، بلدى ، رومى كذلك بذور الكركديه والخبيزة وبذور القطن (صنف جيزة ٧٥) لتقدير محتوى الزيت ، الخصائص الطبيعية والكيميائية له ، تركيب الأحماض الدهنيه، المحتوى من الأحماض الدهنية الحلقية Cyclopropenoid ، الفوسفوليبدات ، الجوسيبول والمحتوى من المواد الغير متصبنه.

أوضحت النتائج أن نسبه الزيت تتراوح ما بين ١٥,٣٪ لبذرة الباميا صنف بودا الى ٢١,٥٪ لبذرة الكركديه.

الأحماض الدهنية فى زيوت الأصناف المختلفة موضع الدراسة تتماثل مع تلك الموجودة فى زيت بذرة القطن ولكن نسبة كل منها تختلف من زيت الى اخر. الأحماض الدهنية الرئيسية هى البالميتك (١٥,٢٧ – ٣٤,٣٣ ٪) ، الأوليك (٢١,٨٦ – ٣٨,٢٧٪) و اللينوليك (٢٣,٦٣ – ٤٩,٧٥٪). وقد لوحظ اختلافات فى النسبة ما بين حامض الأوليك / حامض اللينوليك. كما وجد ان كل الزيوت تعطى لونا أحمر مميزا مع اختيار هالفن دليلا على وجود أحماض حلقية .Cyclopropenod

كما أشارت النتائج ان نسبة المواد الغير قابلة للتصبن تتراوح ما بين ٠,٩٨ – ١,١٦٪ وتشكل الهيدروكربونات من ٨,٠٥٪ (زيت بذرة لكركديه) الى ٢٥,٣٣٪ (زيت بذرة الباميا صنف بوذا) من مكونات المواد الغير قابلة للتصبن ويكون مركب سكولين هو المركب الأساسى للهيدروكربونات (٢,٨٢ – ١٠,٩٦ ٪) بينما تمثل الاستيرولات المكون الأساسى من المواد الغير قابلة للتصبن. البيتاسيتواستيرول هو المركب الرئيسى للاستيرولات (٦٥,٢٣ – ٨٤,٠٢٪) بجانب كمباستيرول (٥,٠٨ – ٣,٩٨٪).

كما اظهرت النتائج أن زيت بذرة القطن الخام يكون مقاوما للأكسدة بالهواء الجوى نظرا لوجود صبغة الجوسيبول التى تعمل كمادة مضادة للأكسدة طبيعيا وكذلك لدور الفوسفوليبدات المساعد.

وقد أثبتت هذه الدراسة صلاحية زيت بذور الباميا كمصدر إضافى للزيوت النباتيه الغذائيه نظرا لأرتفاع نسبة الأحماض الدهنية الغير مشبعة، خلوه من الجوسيبول ومحتواه المنخفض من الأحماض الدهنية الحلقية Cyclopropenoid بالاضافة الى صفاء لونه بينما لا تصلح زيوت بذور الكركديه والخبيزة للأستهلاك الأدمى وذلك لأرتفاع رقم الحموضه ونسبة الأحماض الدهنية الحلقية Cyclopropenoid .