CHARACTERISTICS AND COMPOSITION OF PUMPKIN (CUCURBITA MAXIMA) AND LUFFA (LUFFA CYLINDRICA) SEED OILS

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خواص وتركيب زيت بذور القرع واللوف

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ملخص البحث

وجد أن بذور القرع العسلى واللوف تحتوى على ٣٤,٨٪ ، ٢٣,٥٪ زيت على التوالى .

وقد أثبت التحليل الكروماتوجرافى الغازى أن الأحماض الدهنية الغير مشبعة تمثل ٧٨,١٤٪ من زيت القرع بينما نسبتها فى زيت اللوف تصل الى ٧٣,٩٥٪ .

وكان حمض الأوليك أكثر الأحماض وجودا فى زيت القرع بينما كان حامض اللينوليك هو الأكثر وجودا فى زيت اللوف .

وكانت خواص زيت القرع كالآتى : الرقم اليودى : ١٣٤,٣٠ ورقم التصبن : ١٩٢,٤ ورقم الحامض : ١,١٥ ومعامل الانكسار : ١,٤٧٢ والكثافة : ٩١٧, وأما المواد الغير متصبنة فنسبتها ١,١٨٪ .

بينما كانت خواص زيت اللوف كالآتى : الرقم اليودى : ١٠٧,٣ ورقم التصبن : ٢٠٥,٧٢ ورقم الحامض : ٩٤, ومعامل الانكسار : ١,٤٦٥ والكثافة : ٠,٩٢٩ . وأما نسبة المواد الغير متصبنه فهى ١,٦٢٪ .

ABSTRACT

Fluted pumpkin cucurbita maxima and luffa cylindrica seeds were investigated. The oil contents were 34.8% and 23.5% at the above order respectively. The fatty acid composition showed that the unsaturated fatty acids were 78.14% for fluted pumpkin oil and 73.95% for luffa cylindrica oil. The predominant fatty acid in pumpkin oil was oleic acid whereas linoleic acid was the major unsaturated fatty acid in luffa oil. The iodine value, saponification number, acid value, refractive index sp. gravity and UNS were 134.3, 192.4, 1.15, 1.472, 0.917 and 1.18% for pumpkin oil while the above values were 107.3, 205.72, 0.94, 1.465, 0.929 and 1.62% when luffa oil was considered.

INTRODUCTION

The nutritive value of fluted pumpkin oil attracted the attention of several investigators. Vasconcellos et al. (1980) indicated that this oil is similar to other common edible oils and added that linoleic acid is the predominant fatty acid ranged from 39-77%.

The lipids content of luffa cylindrica was also investigated by Longe et al. (1983) who mentioned that oleic acid and linoleic acid were the predominant fatty acids in fluted pumpkin oil.

The results obtained by Yuksekish, and Ozensoy (1978), Joshi and Shrivostava (1978), indicated that luffa cylindrica seeds are potentially valuable as another useful source of oil too. The highly unsaturated nature of both oils should make them very attractive for food purpose, as noticed by Vasconcellos et al.(1980), and Joshi and Shrivostava (1978).

The continuous increase in population, especially, in developing countries as well as the increase demand for oils and their products, necessitate the investigation for any other additive sources that may participate in solving oils shortage.

In this point of view attention were given here to assist in further the status of the oils produced from pumpkin and luffa in terms of lipids content and their composition of fatty acids and UNS fractions.

MATERIAL AND METHODS

The pumpkin cucurbita and luffa cylindrica seeds were collected after ripining stage during the season of (1987). The seeds were washed and air dried for 72 hrs, then the dried seeds were crushed and subjected to oil extraction by soaking in n-hexane according to Dhoperhwarker and Mead (1961). Oil percentage refractive index, specific gravity, saponification number, iodine value and unsaponifiable matter were determined according to A.O.A.C. methods (1980).

TL-Chromatography:

The nonpolar lipid fraction was cleaned up via silicic acid adsorption chromatography similar to Zaderiowski and Sosulski (1978).

The separation of such nonpolar fraction to its classes was carried out by thin layer chromatography using silica gel G plates 20x20 cm., layer thickness 0.25 mm. using the solvent system : petroleum ether : diethyl ether : acetic acid 80/20/1 v/v/v/. The separated spots were visualized on a dried plate by means of iodine vapours.

GLC analysis:

Methyl esters of fatty acids were prepared similar to Seelback and Quackenlush (1957). The composition of fatty acids were achieved by GLC analysis using by Unicom gas chromatography, Model 104,fitted with flame ionization detector, the column filled with 10% PEGA on the acid washed diatomate 100-200 mesh. The operating conditions were: N_2 45 ml/min, H_2 45 ml/min, detection temperature 220°C, chart speed 2 cm/min.

UNS analysis:

The unsaponifiable matters were separated according to Maia et al. (1976). The ethereal extracts of the UNS were passed over basic copper carbonate for their purification from any traces of free fatty acids as recommended by Capella et al. (1960). The sterol fraction of the unsaponifiable matters of both oils were separated on a florisil column according to Eisner and Firestone (1963). The isolated sterols were fractionated by GLC using the Pye unicum gas chromatography Model 104 with flame ionization detector. The operating conditions for the GLC determination were, column temperature 270°C, detector temp. 300°C, chart speed 2 min/cm. Identification of sterols was based on comparison of authanitic samples analyzed under the same conditions.

RESULTS AND DISCUSSION

The crude lipid contents of pumpkin seeds were found to be 34.8% (dry wt.) whereas such value was 23.5% concerning luffa seeds. Similar results were reported by Vasconcellos et al. (1980) who mentioned that pumpkin seeds contained 36% crude oil. The results obtained by Yuksekish and Ozensoy (1978) revealed the presence of about 23.8% crude oil in luffa seeds.

The nonpolar fractions of the extracted oils were subjected to fractionation to their major classes via TLC technique. Such classes comparable with those of cotton seed oil are presented in Fig. (1). Such actual chromatogram revealed that the investigated oils exhibited the major classes similar to those existed in cotton seed oil migrated on the same chromatogram.

The separated fractions could be identified from front to origin according to their polarity as follows: sterol esters, triglycerides, free fatty acids, diglycerides and monoglycerides as

stated by Malins and Mangold (1960). It is worthly to notice that the triglycerides fraction was the main constituent of both oils.

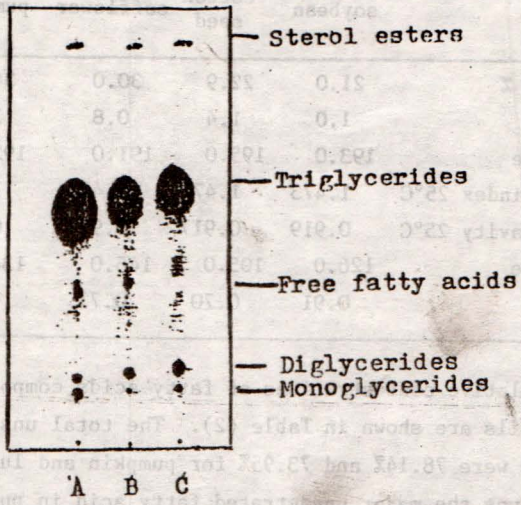

Fig. (1): TLC chromatogram of oil samples of:
A- Pumpkin
C- Luffa
C- Cotton seed

The physical and chemical characteristics of both oils are summarized in Table (1). It could be noticed that the oil contents, iodine value and sap. value of luffa oil are almost similar to those of cotton seed oil. However, some variations could be deduced when pumpkin oil was considered.

Table (1): The physico-chemical properties of the investigated oils comparable with those of same common vegetable oils.

Properties	soybean	cotton seed	safflower	pumpkin	luffa
Oil in seed %	21.0	22.9	30.0	34.8	23.5
Acid value	1.0	1.4	0.8	1.15	0.94
Sapon. value	193.0	195.0	191.0	192.4	205.72
Refractive index 25°C	1.473	1.470	1.475	1.472	1.465
Specific gravity 25°C	0.919	0.917	0.921	0.917	0.929
Iodine value	126.0	105.0	145.0	134.3	107.30
UNS %	0.91	0.70	0.71	1.18	1.62

The relative concentrations of fatty acids composition of pumpkin and luffa oils are shown in Table (2). The total unsaturated fatty acid levels were 78.14% and 73.95% for pumpkin and luffa respectively. Oleic acid was the major unsautrated fatty acid in pumpkin oil 45.81% while linoleic acid was the major component in luffa oil 54.81%. It should be noticed that Kamel et al. (1985) stated that safflower and sunflower revealed high content of linoleic acid.

Table (2): The relative concentration of fatty acids composition of pumpkin and luffa seed oils calculated from GLC.

Fatty acid	Relative concentration % pumpkin	luffa
Myristic	1.81	0.22
Myristoleic	1.44	
Palmitic	14.88	13.93
Palmitoleic	9.15	
Stearic	4.22	11.89
Oleic	45.81	19.14
Linoleic	21.74	54.81

The presence of fairly high amount of the essential fatty acid lenoleic, suggests that luffa oil is highly nutritions. Palmitic acid was the major fatty acid in both pumpkin seed oil 14.88% and luffa seed oil 13.93%. GLC analysis of unsaponifiable matters are presented in Table (3).

Table (3): GLC analysis of the unsaponifiable matters (UNS) of pumpkin and luffa oils.

Sterol	Relative concentration %	
	pumpkin	luffa
Campesterol	5.69	
B-sitosterol	55.58	58.15
Δ^5 Avenasterol	38.72	41.78

Such analysis revealed the presence of three fractions. B-sitosterol was the predominant sterol in the UNS of both oils under investigation whereas its relative concentration was 55.58% in the case of pumpkin UNS and 58.15% concerning the UNS of luffa oil.

Eisner and Firestone (1963) noticed that B-sitosterol was the major sterol in vegetable oils and it constituted 91% of sterol fraction of olive oil. Thampson et al. (1963) mentioned that B-sitosterol was among the principle sterols in UNS of corn oil and the UNS of sunflower oil as noticed by Kozin and Kostornykh (1964). Also, El-Tahawi et al. (1979) stated that B-sitosterol was the major sterol in UNS of Fennel fixed oil. B-sitosterol 30.95% was among the major sterol in the UNS of silybum oil as indicated by El-Tahawi et al. (1987).

Δ^5 avenasterol was presented in considerable amounts 38.72% in the UNS of pumpkin oil and 41.78% in the UNS of luffa oil. In this

connection Garg and Nes (1986) mentioned that avenasterol occurres in marked amounts in UNS extracted from pumpkin and luffa seed oil.

Campsterol was in the concentration of 5.69% in the UNS of pumpkin oil while such sterol was undetectable in the UNS of luffa oil. It should be mentioned that Thampson et al. (1963) noticed that campsterol was among the principle sterols in corn oil and in Fennel fixed oil according to El-Tahawi et al. (1979) and in the concentration of 21.42% in the UNS of Silybum oil as mentioned by El-Tahawi et al. (1987).

REFERENCES

A.O.A.C. (1980). Official method of analysis. Association of official Agriculture chemists. Washington, d.C.

Capella, P.G., G.S. Zotti, A. Ricca, A.F. Valentini and G. Jacini (1960). Chromatography on Silicic acid of the unsaponifiable matter of fats. J. Am. Oil Chem. Sco. 37, 564.

Dhopershwarker, G.A. and J.F. Mead (1961). Role of oleic acid in the metabolism of essential fatty acids. J. Am. Oil Chem. Soc. 28, 297.

Eisner, J. and D. Firestone (1963). Gas chromatography of unsaponifiable matters II. Identification of vegetable oils by their sterols. J. Assoc. Offic. Agric. Chemist's 46 No.3 542-550.

El-Tahawi, B.S., N. El-Shahat and H.A. (1979). Chromatographic studies on fennel fixed oil. Ain Shams Univ. Res. Ball No. 1060, Cairo, Egypt.

El-Tahawi, B.S., S.N. Deraz, S.A. El-Kadousy and F.M. El-Shouny (1987). Chemical studies on Silybum marianum L. Gaertn wild growing in Egypt -I- oil and sterols. Grasas Y Aceites Vol. 38 Fasc. 2: 93-97.

Garg, V.K. and W.R. Nes (1984). Studies the C-24 configurations of Δ^7-sterols in seeds of Cucurbita Maxima. Phytochemistry Vol. 23 No. 12 pp. 2919-2923.

Joshi, S.S. and R.K. Shrivastava (1978). Chemical examination of luffa cylindrica seeds. India, Sect. A 48 4: 211-14.

Kamel, B.S., H. Dawson and Y. Kakuda (1985). Characteristic and composition of melon and grape seed oils and cakes. J. Am. Oil Chem. Soc. 62, 881.

Kozin, N.I. and M.S. Kastornykh (1964). Sterols of sunflower oil. Maslob-Zhir. Prom. 30(V): 11-12. (C.F. C.A., Vol. 61, 12213 e.).

Longe, O.G., G.O. Farinu and B.L. Fetuga (1983). Nutritional value of the fluted pumpkin Telfaria occidentalis. J. Agric. Food Chem. 31: 989-992.

Maia, G.A., W.H. Brown, F.M. Whiting and J.W. Stull (1976). Cashew nut unsaponifiable matter. J. Food Science 41(1): 190-4.

Malins, D.C. and H.K. Mangold (1960). Analysis of complex lipid mixtures by Thin-layer chromatography and complementary methods. J. Am. Oil Chem. Soc. 37-576.

Seelback, C.W. and F.W. Quackenlush (1957). Thermal diffusion fraction: Oils and fats and some derivatives. J. Am. Oil Chem. Soc. 34, 603.

Thampson, M.J., W.E. Robbin and G.L. Baker (1963). The nonhomogeneity of soybean sterol B-sitosterol. Steroids 2,505-512 (C.F. C.A., Vol. 60, 4382).

Vasconcellos, J.A., J.W. Berry, C. Weber, W.P. Bemis and J.C. Scheerens (1980). The properties of cucurbita foetidissima seed oil. J. Am. Oil Chem. Soc. 57, 310.

Yuksekisk, N. and E. Ozensoy (1978). Extraction of luffa cylindrica seeds and characteristics of seed oil. Ankara, Ser. B. 24, 3: 17-23.

Zadernouski, R. and F. Sosulski (1978). Composition of total lipids in Rape seed. J. Am. Oil Chem. Soc. 55, 870.