The Linolenic Acid Content of Peanut Oil[1, 2]

RECENT PUBLISHED REPORTS indicate a lack of general agreement among investigators concerning the linolenic acid content of peanut oil (1,2,3,4). Linolenic acid, if present in more than trace amounts, would be expected to contribute to the development of oxidative rancidity in peanut products and should be considered in the development of new commercial peanut varieties.

In the present work, gas-liquid chromatography (GLC) was used to determine the linolenic acid content of oil obtained from seven varieties of peanuts which differed considerably in genetic background and in degree of oil unsaturation. Oil samples were either obtained by Carver press from mature, cured nuts or by extraction of selected tissues of immature, freshly harvested nuts with a 2:1 mixture of chloroform-methanol. The peanuts used in this study were grown during 1965 at Experiment and Tifton, Ga.

Fatty acid methyl esters were prepared by transmethylation with a 3% solution of sulfuric acid in methanol, as described in a previous report (5), and held at −20C under nitrogen until the time of analysis.

Analyses were made on an F&M Model 700 gas chromatograph, equipped with flame ionization detectors, Honeywell ElectroniK 16 strip chart recorder, and an Infotronics CRS-11HSB digital integrator. Coiled copper columns, 2.4 m × 4.8 mm ID, were packed with 70/80 mesh Gas Chrom P, coated with either 15% (w/w) stabilized diethylene glycol succinate (DEGS) or 15% (w/w) stabilized butane-1, 4-diol succinate (BDS) (Analabs Inc.). Peak identifications were established by a comparison of retention times obtained with samples and authentic standards under identical conditions of operation and by a plot of log retention time versus fatty acid carbon number. For the purpose of identification, comparisons were made on the BDS column, at 175C and 195C with a helium flow rate of 110 ml/min, and on the DEGS column at 153C with a helium flow of 100 ml/min. Under the latter set of conditions methyl linolenate is eluted between methyl arachidate and methyl eicosenoate. All quantitative measurements were made on the BDS column operated either isothermally at 195C or programmed from 185C to 230C at 1C or 2C per minute. The detector and injection port temperatures were maintained at 300C and 260C respectively, and the helium flow rate at 110 ml/min. On column injections of 0.15 μl aliquots of sample methyl esters were made with a Hamilton 710IN 1 μl syringe. Percentage fatty acid composition was determined by digital integration and normalization of peak areas.

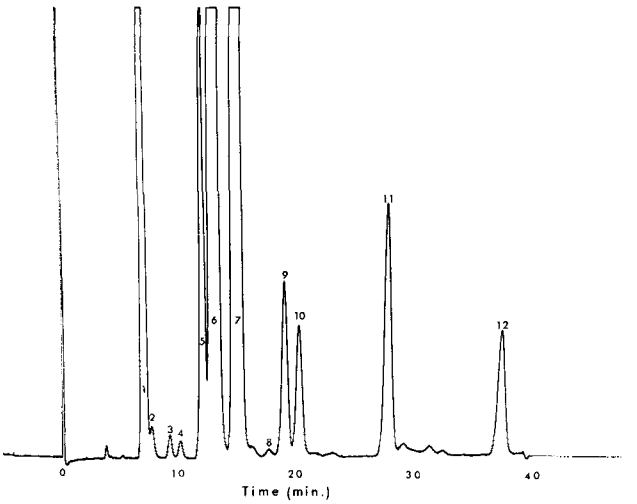

FIG. 1. Chromatogram of peanut oil fatty acid methyl esters run on 15% BDS, starting at 185C and programming at 1C/min. (1) 16:0; (2) 16:1; (3) 17:0; (4) 17:1; (5) 18:0; (6) 18:1; (7) 18:2; (8) 18:3; (9) 20:0; (10) 20:1; (11) 22:0; (12) 24:0.

Analysis of the National Heart Institute type of fatty acid standards KA, KB, KD, and KF (Applied Science Laboratories Inc.) gave results that agreed with the stated composition with a relative error of less than 4% for major components (> 5% of total mixture) and less than 10% for minor components (< 5% of total mixture).

The fatty acid composition of oil obtained from seven varieties of peanuts is shown in Table I. The samples were methylated and analyzed on three separate occasions over a period of several months; the values shown are averages of three determinations.

Linolenic acid was found in the oil of all varieties

[1] Approved as Journal Series Paper No. 81, University of Georgia College of Agriculture Experiment Stations, Georgia Station, Experiment.

[2] This research was supported in part by the Corn Products Company.

TABLE I

Fatty Acid Composition of Oil Obtained from Seven Varieties of Peanuts[1]

Fatty acid	Fatty Acid Composition (%)							
	S.E. Runner	Dixie Spanish	Va. Bunch	Bynum Runner	Florida 393–1–7	Bleckley	Valencia	CV[2] (%)
16:0	9.60	12.45	9.24	8.19	7.51	7.48	10.35	2.25
16:1	0.14	0.09	0.11	0.11	0.08	0.09	0.09	9.61
17:0	0.11	0.06	0.08	0.06	0.07	0.05	0.06	9.91
17:1	0.07	0.01	0.06	0.03	0.04	0.03	0.02	19.90
18:0	2.83	3.43	2.77	3.91	3.11	4.92	3.57	3.72
18:1	46.91	41.35	52.33	64.97	61.99	67.44	42.82	0.67
18:2	34.76	35.13	28.49	16.22	19.11	13.90	35.13	2.08
18:3	0.04	0.02	0.04	0.02	0.02	0.02	0.03	14.78
20:0	1.25	1.58	1.38	1.66	1.65	1.88	1.59	3.47
20:1	0.94	0.89	1.25	1.01	1.45	0.84	1.09	3.54
22:0	2.16	3.59	2.73	2.65	3.42	2.34	3.45	4.71
24:0	1.14	1.39	1.45	1.15	1.52	0.98	1.67	9.95

[1] Values given are averages of three determinations.
[2] Coefficient of variation.

but at a level not exceeding approximately 0.04% of total fatty acids. Analysis of oil from immature peanuts reveals a somewhat higher content of linolenic acid, particularly in tissues other than the cotyledon. Details of this work will be reported elsewhere.

In addition to the fatty acids reported in Table I, several additional acids, reported by Iverson et al. (4) to be present in peanut oil, were detected in trace amounts. However the eight major fatty acids account for more than 98% of the total fatty acid composition of peanut oil. A typical chromatogram is shown in Figure 1.

Although the proportion of methyl linolenate in synthetic standards has been observed to decrease with time during storage at −20C, little change has been observed in the linolenic acid content of peanut oil stored under similar conditions. The stability of linolenic acid in peanut oil is attributed to the presence of naturally occurring antioxidants.

The data obtained thus far show that the linolenic acid content of peanut oil obtained from mature nuts is uniformly low and suggest that the tendency of oil of some peanut varieties to develop oxidative rancidity is not correlated with the linolenic acid content.

ACKNOWLEDGMENT

The three varieties of peanuts used in this study were supplied by R. O. Hammons.

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[Received May 22, 1967]