1,2,4,7,8-pentachlorofurans, were examined, along with the sample extract. A HCDD standard was used to determine instrument sensitivity at the time of the analyses. It was estimated that dioxins present at a level of 0.5 ppb or higher would have been identified on the assumption that all dioxins in the sample gave a similar response in the mass spectrometer. The presence of the following components was confirmed in the sample: HCDDs, HpCDDs, OCDD, and penta-, hexa-, and heptachlorofuran. Results obtained in the mass spectral analysis are illustrated in Figure 6, which shows the mass spectrum of a 1,2,3,4,6,7,8-HpCDD standard (A) as well as that of the HpCDD component in the sample (B) with the same GLC retention time as the standard. The typical M – (CO + Cl) and M – 2(CO + Cl) fragments are seen in both standard and sample spectra, as well as the HpCDD molecular ion cluster.

ACKNOWLEDGMENT

The author thanks the following members of the Food and Drug Administration for their assistance: J. A. G. Roach for carrying out the GLC–MS analysis, A. E. Pohland for providing the TCDD and OCDD, and I. H. Pomerantz for supplying the OCDF and TCDF.

LITERATURE CITED

Baughman, R., Meselson, M., *Environ. Health Perspect.* **5**, 27 (1973).
Baughman, R., private communication, 1973.
Buser, H. R., *J. Chromatogr.* **129**, 303 (1976).
Buser, H. R., Bosshardt, H. P., *J. Assoc. Off. Anal. Chem.* **59**, 562 (1976).
Firestone, D., Ress, J., Brown, N. L., Barron, R. P., Damico, J. N., *J. Assoc. Off. Anal. Chem.* **55**, 85 (1972).
Firestone, D., *Environ. Health Perspect.* **5**, 59 (1973).
Flick, D. F., Firestone, D., Marliac, J. P., *Poultry Sci.* **44**, 1214 (1965).
Flick, D. F., Firestone, D., Higginbotham, G. R., *Poultry Sci.* **51**, 2026 (1972).
Gelatin manufacturers Institute of America, Inc., "Gelatin", New York, N.Y., 1973.
Harris, M. W., Moore, J. A., Vos, J. G., Gupta, B. N., *Environ. Health Perspect.* **5**, 101 (1973).
Higginbotham, G. R., Huang, A., Firestone, D., Verrett, J., Ress, J., Campbell, A. D., *Nature (London)* **220**, 702 (1968).
Kim, P., Yang, G. C., Firestone, D., Pohland, A. E., "Photochemical Dechlorination of Chlorinated Dibenzo-*p*-dioxins", presented at the First Chemical Congress of the North American Continent, Mexico City, Nov 1975.
Kulka, M., *Can. J. Chem.* **39**, 1937 (1961).
Lewis, P. F., private communication, 1975.
Moore, J. A., Gupta, B. N., Vos, J. G., Proceedings of the National Conference on Polychlorinated Biphenyls, Nov 19–21, 1975, Chicago, Ill. pp 77–80.
Neubert, D., Zens, P., Rothenwallner, A., Merker, H.-J., *Environ. Health Perspect.* **5**, 67 (1973).
Pohland, A. E., Yang, G. C., *J. Agric. Food Chem.* **20**, 1093 (1972).
Pomerantz, I. H., private communication, 1975.
Schwetz, B. A., Norris, J. M., Sparschu, G. L., Rowe, V. K., Gehring, P. J., Emerson, J. L., Gerbig, C. G., *Environ. Health Perspect.* **5**, 87 (1973).
Trotter, W. J., private communication, 1975.

Received for review April 1, 1977. Accepted July 27, 1977. This paper was presented at the 90th Annual Meeting of the Association of Official Analytical Chemists, Oct 18–21, 1976, Washington, D.C.

Individual Lipids and Proximate Analysis of Various Foods. 1. French Fried Potatoes from Ten Chain Restaurants

Willard D. Hubbard,* Allan R. Prosser, Alan J. Sheppard, David R. Newkirk, Theodore Osgood, Elias Tombropoulos, and Shirley T. Jones

French fried potatoes were obtained every third day from ten chain restaurants for a total of six samplings from each restaurant. The samples were analyzed for water, total fat, fatty acids, protein, ash, sterols, and *cis,cis*-methylene interrupted polyunsaturated triglycerides. The data show that variations exist in the day-to-day selection of cooking oils used within a single restaurant. Also, the wide variations in data from one restaurant to another indicate that different oils were being selected. Values for total fat ranged from 14.0 to 28.4 g/100 g of product, and cholesterol values varied from near zero to 19.0 mg/100 g of product. Several restaurants appeared to use mixtures of animal and vegetable fats. One establishment used only a vegetable oil and others used only animal fat.

More information is needed on the analysis of foods supplied by fast-food chain restaurants in view of the relatively large number of meals consumed by the public in these establishments. Of particular interest is the cholesterol and fatty acid content of foods. Samples of french fried potatoes were obtained from ten major fast-food chain restaurants. Water, total fat, fatty acids, protein, ash, sterols, and *cis,cis*-methylene interrupted polyunsaturated triglycerides were determined.

MATERIALS AND METHODS

Ten restaurants were each visited a total of six times in a sequence of every third day for collection of samples. The restaurants were Arby's, Burger Chef, Burger King, Gino's, Hardee's, Hot Shoppe Jr., Jack in the Box, McDonald's, Red Barn, and Roy Rogers. (The data in the tables do not reflect this order of listing.) Samples were homogenized in a Waring blender and stored at −2 °C for a few days before extraction. The extraction procedure, using chloroform–methanol, has been described by Sheppard et al. (1974). A sufficient amount of sample was taken for the extraction step so that approximately 1 g of fat was recovered. The methyl esters of the fatty acids were prepared by the procedure of the Association of Official Analytical Chemists (AOAC, 1975) as modified by Solomon et al. (1974). The method for the preparation of the butyrate derivatives for sterol analysis and the method for cholesterol have been described by Sheppard et al. (1974). Official methods of the AOAC (1975) were used

Division of Nutrition, Food and Drug Administration, Washington, D.C. 20204.

Table I. Fatty Acid and *cis,cis*-Methylene Interrupted Polyunsaturated Triglyceride (MIPT) Content (g/100 g of product) of French Fried Potatoes from Ten Fast-Food Restaurants[a]

Restaurant	Fatty acid methyl esters								
	C14:0	C14:1	C16:0	C16:1	C18:0	C18:1	C18:2	C18:3	MIPT
A	0.5 ± 0.1	0.2 ± 0.1	4.3 ± 0.4	0.5 ± 0.2	2.7 ± 0.4	6.2 ± 0.7	0.5 ± 0.1	0.1 ± 0.1	0.3 ± 0.1
B	0.1 ± 0.1	ND[b]	3.8 ± 0.7	ND	1.1 ± 0.1	8.2 ± 1.2	1.2 ± 0.6	0.1 ± 0.1	0.8 ± 0.5
C	0.5 ± 0.1	0.2 ± 0.1	4.2 ± 0.5	0.5 ± 0.1	3.0 ± 0.4	6.9 ± 0.8	0.5 ± 0.1	Tr[c]	0.3 ± 0.1
D	Tr	ND	3.0 ± 0.4	ND	3.1 ± 0.5	17.0 ± 2.5	0.1 ± 0.1	ND	Tr
E	0.5 ± 0.1	0.2 ± 0.1	4.1 ± 0.5	0.4 ± 0.1	2.9 ± 0.4	7.2 ± 0.9	0.7 ± 0.1	Tr	0.5 ± 0.2
F	0.3 ± 0.1	0.1 ± 0.1	3.8 ± 0.5	0.4 ± 0.1	2.2 ± 0.3	6.4 ± 0.8	2.1 ± 0.7	0.2 ± 0.02	1.6 ± 0.4
G	0.3 ± 0.05	0.1 ± 0.1	3.4 ± 0.1	0.3 ± 0.1	2.6 ± 0.1	6.8 ± 0.5	1.2 ± 0.4	0.1 ± 0.1	0.8 ± 0.3
H	0.2 ± 0.1	Tr	2.5 ± 0.4	0.1 ± 0.1	1.5 ± 0.2	8.0 ± 0.8	0.8 ± 0.2	0.1 ± 0.1	0.5 ± 0.1
I	0.4 ± 0.05	0.2 ± 0.1	4.1 ± 0.2	0.5 ± 0.2	2.5 ± 0.3	6.5 ± 0.3	0.8 ± 0.3	0.1 ± 0.1	0.6 ± 0.2
J	0.5 ± 0.1	0.1 ± 0.1	4.4 ± 0.6	0.4 ± 0.2	2.3 ± 0.4	6.8 ± 0.7	1.0 ± 0.2	0.1 ± 0.1	0.8 ± 0.2

[a] Mean values ± standard deviation of six samples assayed in duplicate. [b] ND = none detected. [c] Tr = <0.1 g/100 g of product.

Table II. Proximate Analysis and Sterol Content of French Fried Potatoes from Ten Fast-Food Restaurants[a]

Restaurant	Proximate analysis, g/100 g of product				Sterols, mg/100 g of product			
	Water	Protein	Ash	Total fat	Cholesterol	Campesterol	Stigmasterol	Sitosterol
A	40.9 ± 3.9	4.2 ± 0.4	1.4 ± 0.2	16.0 ± 1.8	16.5 ± 2.5	ND[b]	ND	ND
B	41.5 ± 4.2	3.7 ± 0.3	1.6 ± 0.3	15.5 ± 1.3	ND	ND	ND	18.3 ± 4.4
C	35.6 ± 3.6	4.1 ± 0.3	1.7 ± 0.3	16.4 ± 1.6	18.2 ± 3.6	ND	ND	ND
D	32.1 ± 2.3	3.4 ± 0.2	3.0 ± 0.2	28.4 ± 4.9	ND	12.8 ± 6.9	10.8 ± 6.9	28.7 ± 6.7
E	40.2 ± 5.6	3.9 ± 0.2	1.7 ± 0.3	17.0 ± 1.9	13.1 ± 8.7	ND	ND	ND
F	38.3 ± 1.0	3.4 ± 0.2	1.5 ± 0.2	16.1 ± 1.5	13.7 ± 3.1	ND	ND	7.7 ± 8.2
G	38.2 ± 3.9	4.0 ± 0.5	1.9 ± 0.2	16.0 ± 0.9	12.1 ± 3.0	ND	ND	6.6 ± 9.9
H	43.3 ± 1.6	4.0 ± 0.4	2.0 ± 0.1	14.0 ± 0.8	4.2 ± 3.3	4.4 ± 5.0	2.8 ± 4.6	18.1 ± 1.7
I	35.9 ± 0.8	4.6 ± 0.3	2.0 ± 0.4	16.0 ± 1.2	19.0 ± 3.0	ND	ND	ND
J	33.0 ± 3.0	4.6 ± 0.5	1.9 ± 0.2	16.5 ± 1.7	17.8 ± 2.4	ND	ND	ND

[a] Mean values ± standard deviation of six samples assayed in duplicate. [b] ND = none detected.

for the determination of water, protein, and ash.

RESULTS AND DISCUSSION

All samples were analyzed in duplicate. The data (Tables I and II) are mean values ± standard deviations for the 12 observations, i.e., six samples in duplicate from each restaurant. When standard deviation values are low, it is probable that the particular restaurant had been using the same type (source) of cooking oil during the sampling period. Conversely, changes in source of oils would appear as higher standard deviations.

The wide variations in data from one restaurant to another indicate that different oils are being selected and to a lesser degree that a single restaurant changes its cooking oil source from day to day. However, the samples from restaurants A, C, E, I, and J are reasonably similar in fatty acid methyl ester (Table I) and total fat (Table II) content. The results from restaurant D are unique for the series. The high percentages of C18:1 and total fat reveal that its fat source is quite different from the others. The finding of C12:0 fatty acid methyl esters (not shown in Table I) in three of six samplings from restaurant H indicates that coconut or palm kernel oil may have been used as an oil source during the test period.

In Table II, the similarities between restaurants A, C, E, I, and J are again present, with restaurant D in a separate category. This restaurant may have been changing its source of oil frequently, since wide variations were observed in the data for campesterol, stigmasterol, and sitosterol on a day-to-day basis.

Restaurants F, G, and H appear to use mixtures of animal and vegetable fats, since both cholesterol and sitosterol were found. Restaurant B used only a vegetable oil. The samples from restaurant D have the lowest water content, highest ash content, and highest total fat content of any of the samples. The ash content and total fat content of samples from restaurant D were significantly different from those obtained from the other restaurants when subjected to statistical analysis using the outlier test.

LITERATURE CITED

Association of Official Analytical Chemists, "Official Methods of Analysis," 12th ed, Washington, D.C., 1975, Sections 28.057–28.060.

Sheppard, A. J., Hubbard, W. D., Prosser, A. R., Interim Methodology Instructions No. 2 with modification No. 1 dated April 16, 1975, for Implementing Requirements of Section 1.18 of Title 21, Chapter 1, Subchapter A, Part I ("Labeling of Foods in Relation to Fat, Fatty Acid and Cholesterol Content") issued June 11, 1974, Division of Nutrition, Bureau of Foods, Food and Drug Administration, Washington, D.C.

Solomon, H. L., Hubbard, W. D., Prosser, A. R., Sheppard, A. J., *J. Am. Oil Chem. Soc.* **51**, 424 (1974).

Received for review February 24, 1977. Accepted July 21, 1977. This work was part of an interagency agreement with the National Institutes of Health.