Non-detectable Levels of *trans*-Fatty Acids in Peanut Butter

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The fatty acid composition of 11 brands of peanut butter and paste freshly prepared from roasted peanuts was analyzed with emphasis on isomeric *trans*-fatty acids. No *trans*-fatty acids were detected in any of the samples in an analytical system with a detection threshold of 0.01% of the sample weight. Hydrogenated vegetable oils are added to peanut butters at levels of 1−2% to prevent oil separation. Some hydrogenated vegetable oils are known to be sources of *trans*-fatty acids in the human diet. The addition of these products was not found to result in measurable amounts of *trans*-fatty acids in the peanut butters analyzed.

Keywords: *trans-fatty acids; fatty acid profiles; peanut butter; oil content*

INTRODUCTION

The controversy over *trans*-fatty acids in human diets relative to potential health hazards still exists after many years of research (*1*). The effects of dietary *trans*-fatty acids on serum lipoproteins have been reported (*2*). The specific role of *trans*-fatty acids on biological functions of specified health and disease has not been determined, but the effects of *trans*-fatty acids in increasing plasma lipids and lipoprotein concentration is often taken as a strong indication of potential risk for development of atherosclerotic cardiovascular disease (*3*). Although intake of *trans*-fatty acids apparently has not increased since the mid 1970s (*1*), the concern in public sectors for *trans*-fatty acids in individual foods is common. European markets have seen decreases in the amounts of *trans*-fatty acids in margarine type products in attempts to reduce consumption of *trans*-fatty acids (*4*). Surveys of the fatty acid contents of spreads and cooking fats are available (*5*). Hydrogenated vegetable oils have been shown to be sources of *trans*-fatty acids. The concentration of *trans*-fatty acids in hydrogenated oil is correlated to the conditions (temperature, pressure, and catalyst) of hydrogenation of vegetable oils (*6*).

Recent consumer and media concern over the addition of hydrogenated oil to various products including peanut butter prompted this examination of commercially available peanut butter for the presence of *trans*-fatty acids. Manufacturers add small quantities (1−2%) of hydrogenated vegetable oils to peanut butter as stabilizers to prevent oil separation during handling and storage. Nutritional data sheets for two widely used stabilizers for peanut butter, Dritex RC Beads and Dritex RCS Beads (ACH Food Co., Memphis, TN), indicate >98% saturated fat and <0.5 g of *trans*-fatty acids per 100 g of stabilizer. These data indicate that only very small quantities of *trans*-fatty acids are added if only 1−2% of these stabilizers are added to peanut butter.

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MATERIALS AND METHODS

Sampling of Peanut Butters. Six different peanut butter sample production dates (codes) were obtained for each of four national brands of peanut butter. The brands tested were Jif, Peter Pan, Reese's, and Skippy. At least two code date samples were acquired for several private label brands (store brands) including Dominick's, Giant Foods, Hannaford, Jewel, Kroger, Pathmark, and Safeway. Two natural (no stabilizers added) brands, Laura Scudder's Natural and Smucker's Natural, were also tested. Four different code dates of Smucker's and two code dates of the Laura Scudder's were obtained. To provide the most variable sampling possible within the limits of the study, samples were obtained from New York, NY; San Francisco, CA; Albany, GA; Chicago, IL; Raleigh, NC; and Washington, DC, as available.

Sample Preparation. Peanut paste was prepared from six different lots of medium grade size, runner type peanuts obtained from a commercial source. Using the methods of Sanders et al. (*7*), samples of 200−250 g were dry-roasted, and paste was prepared using a Cuisinart food processor. A precise grind-cool protocol was used to maintain temperature below 32 °C.

A 15-g subsample was taken from each product for analysis. One jar of each brand was sampled three times to obtain data on analytical variance. Samples were placed in 15-mL glass vials with a snap seal lid and numerically coded using random three-digit numbers. All samples were sent overnight from Raleigh, NC, to Woodson-Tenent Laboratories in Memphis, TN, for analysis.

Oil Extraction. Lipid was extracted from the samples using an automated Soxtec instrument, a modification of AOAC method 4.5.01 (*8*). Three grams of peanut butter was weighed into extraction thimbles and mixed with ∼10 g of sand to allow for efficient drying. Samples were dried at 60 °C for 18 h in a vacuum oven. Thimbles containing samples were loaded into a Soxtec model 1043 (Foss Tecator AB, Sweden) and extracted for 20 min with petroleum ether. Solvent was collected from each sample in extraction cups that had been prerinsed with acetone prior to use. Five milliliters of solvent, containing ∼0.1 g of lipid, was transferred to a 100-mL volumetric flask.

Fatty Acid Analysis. Fatty acid methyl esters were prepared from the extracted lipid materials according to AOCS method Ce 1b-89 (*9*). Extraction solvent was evaporated under a stream of nitrogen. Five milliliters of tridecanoic acid (C13:0) internal standard solution in hexane (1.25 mg/mL) was added to each sample. Four milliliters of 0.5 N NaOH in methanol was added to each flask. Flasks were heated for 5 min on a steam bath to hydrolyze the fatty acids. After cooling,

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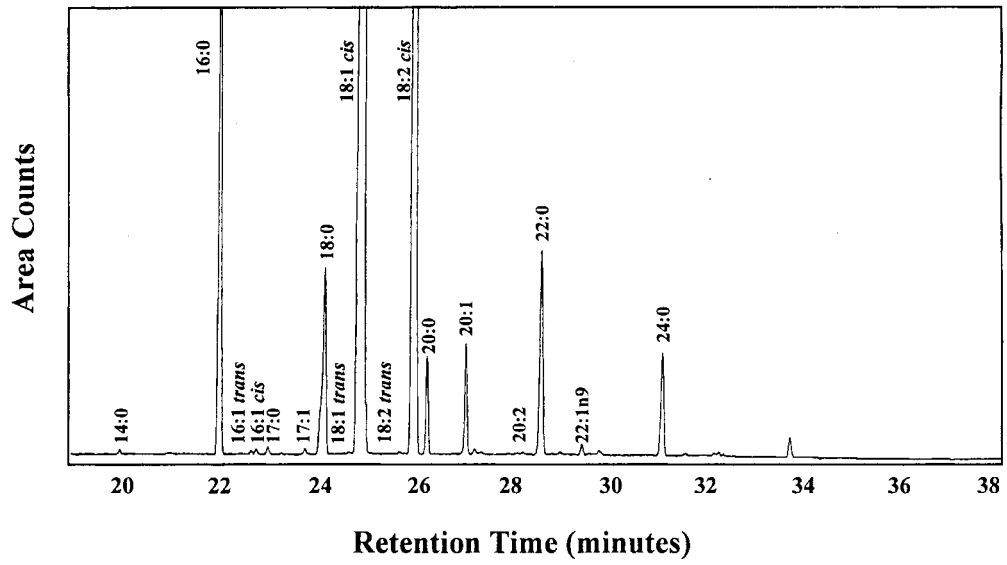

Figure 1. Representative GC chromatogram of fatty acid methyl esters from peanut butter.

5 mL of boron trifluoride solution (14% in methanol) was added to each flask, and samples were reheated for 5 min. Flasks were removed from the heat and allowed to cool to room temperature, when 10 mL of hexane was added to each flask. Flasks were shaken by hand to extract the methyl esters into the organic layer. The hexane extracts were dried over anhydrous sodium sulfate and analyzed using gas chromatography.

Fatty acid methyl ester analysis was performed on a Hewlett-Packard 5890 gas chromatograph (Hewlett-Packard Co., Palo Alto, CA) equipped with a flame ionization detector and a fused silica capillary (100 m × 0.25 mm) column with biscyanopropyl polysiloxane as the stationary phase (SP-2560, Supelco, Inc., Bellefonte, PA). The carrier gas was nitrogen at 12 cm/s, and the column was programmed to heat from 145 to 220° at 4 °C/ min with an initial hold time of 4 min. After 35-min hold at 220 °C, the temperature was increased to 240 °C at 4 °C/min and held for 10 min. The injector and detector were set at 250 °C. The injector was split with a split flow of 24.8 mL/min. Data were collected using a Hewlett-Packard model 3396 series II integrator. Fatty acid percentages were calculated using response factors for the methyl esters identified. Identifications were made on the basis of retention time compared to known reference standards purchased from Nu-Chek Prep, Inc. (Elysian, MN). Qualitative accuracy was verified daily by analysis of previously characterized soybean oil and spike recoveries.

RESULTS AND DISCUSSION

A chromatogram showing the typical fatty acid profile from a random peanut butter is similar to published data from peanuts (Figure 1). The limit of detection for the analytical system for any individual fatty acid was 0.01% of the total sample by weight. None of the samples tested in this study were found to contain detectable levels of *trans*-fatty acids. The *cis* unsaturated fatty acids, oleic (C18:1), linoleic (C18:2), and gadoleic (C20:1), were found in measurable amounts in all of the samples. Oleic acid, the most abundant fatty acid in peanuts, was found at levels ranging from 18.9% in one private label brand to 26.8% in one natural type. Mean fatty acid percentages of pooled sample data were similar (Table 1). Differences in percentage are within expected variation found among cultivars and areas of production for peanuts used by various processors in the production of peanut butter (*10*).

Table 1. Mean Fatty Acid Content (Weight Percent) of Brand Groups of Peanut Butters

fatty acid	national	private label	natural	peanut paste
C16:0	5.31 ± 0.33	4.82 ± 0.34	4.84 ± 0.74	5.52
C18:0	2.06 ± 0.24	1.90 ± 0.14	1.23 ± 0.33	1.49
C18:1, cis	22.6 ± 1.5	21.0 ± 1.7	23.4 ± 4.9	25.3
C18:2, cis	13.4 ± 1.1	12.5 ± 1.2	12.3 ± 0.6	16.9
C20:0	0.65 ± 0.04	0.63 ± 0.06	0.54 ± 0.25	0.74
C20:1, cis	0.64 ± 0.10	0.61 ± 0.04	0.62 ± 0.00	0.66
C22:0	1.70 ± 0.03	1.62 ± 0.11	1.29 ± 0.25	1.51
C24:0	0.81 ± 0.06	0.76 ± 0.05	0.77 ± 0.04	0.87

The current regulations for nutritional labeling do not require *trans*-fatty acids to be listed on the product Nutritional Facts panel (*11*). At this writing, other fatty acid classes, such as saturated fatty acids, are required to be listed at levels >0.5 g per serving size. Future action is expected to require that *trans*-fatty acids in foods be on labels (*12*). The serving size for peanut butter is defined as 2 tablespoons, which is equal to 32 g. To reach a reportable level of *trans*-fatty acids in this serving size, the hydrogenated oil added at the upper level of 2% would have to contain 80% *trans*-fatty acids to be reportable at 0.5 g perserving. On the basis of this study, the amount of hydrogenated oil added to peanut butter formulations does not add *trans*-fatty acids in these products to the levels detectable by our analyses. Consumption of these products should, therefore, not be of concern to individuals monitoring *trans*-fatty acid intake. Natural types and freshly ground peanuts were not found to be different from commercial peanut butters in *trans*-fatty acid content.

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