LETTER TO THE EDITOR

AOCS Method Ce 1c-89 Underestimates the *trans*-Octadecenoate Content in Favor of the *cis* Isomers in Partially Hydrogenated Vegetable Oils

Sir,

AOCS Method Ce 1c-89 (revised 1990) has been designed to evaluate, by a single capillary gas-liquid chromatographic procedure (GLC) with an SP-2340 flexible fused silica capillary column, the fatty acid composition, level of *trans* unsaturation and *cis,cis* methylene-interrupted unsaturation in partially hydrogenated vegetable oils (PHVO). This same method is used to determine *cis* and *trans*-octadecenoates (18:1*c* and 18:1*t*). Recently, AOAC recommended the adoption of the same GLC procedure (1). The direct GLC procedure was based on the assumption that 18:1*c* and 18:1*t* isomers are completely separable on the SP-2340 column. It is important to recognize that PHVO are a complex mixture of positional and geometric isomers of 18:1, 18:2 and 18:3. Fortunately, on SP-2340, there is no serious overlap between the 18:1 and 18:2 isomers, or between the 18:2 and 18:3 isomers. However, as demonstrated in our experiments (2,3) and by others (4,5), a complete resolution of 18:1*t* as a group from that of the *cis* isomers is not feasible on SP-2340 or any other cyanosilicone capillary column (*e.g.*, SP-2560) (3,6). In cyanosilicone columns, and perhaps in columns of similar polarity, the early eluting 18:1*t* isomers with low Δ values are well separated from the 18:1*c* isomers, but the 18:1*t* isomers with high Δ values (*i.e.*, Δ12 to Δ15) are under the 18:1Δc9 peak, which is the major 18:1*c* isomer in PHVO. Because PHVO may contain an appreciable amount of 18:1*t* isomers with high Δ values (4), the above-mentioned *cis/trans* overlaps should not be ignored.

We have applied the AOCS direct GLC method to margarine samples and found that the AOCS method underestimates the total 18:1*t* values by a substantial margin in favor of the *cis* isomers (3), which is a consequence of the error from the aforementioned *cis/trans* 18:1 isomer overlap. In some margarines, the underestimation in determining the total 18:1*t* can be as high as 32%. The levels of 18:1*t* isomers of high Δ values may depend on the hydrogenation conditions and the source oil, and this will result in variation in the extent of overlaps of the isomers from one PHVO to another. The concentration of the methyl esters applied to the GLC could also influence the *cis* and *trans* resolution (5).

Because there is a renewed interest on the health effects of *trans* fatty acids, it is important to be able to determine them accurately in dietary fats. In Canada, the voluntary nutritional labelling regulations of foods require that monounsaturates only of the *cis* configuration be declared on the label. This also necessitates accurate determination of *cis*- and *trans*-monounsaturated fatty acids in food fats. For the reasons discussed, the use of the AOCS Method Ce 1c-89 in such applications should not be advocated. The recently proposed GLC-IR (infrared) procedure (3) should be useful for accurate determination of the fatty acid composition, including the *cis*- and *trans*-octadecenoates in PHVO and dietary fats. However, for applications where higher accuracy is not required, the AOCS method may be acceptable.

REFERENCES

1. General Referee Report on Oils and Fats, *J. Assoc. Off. Anal. Chem. 73*:105 (1990).
2. Ratnayake, W.M.N., and J.L. Beare-Rogers, *J. Chromatog. Sci. 28*:633 (1990).
3. Ratnayake, W.M.N., R. Holywood, E. O'Grady and J.L. Beare-Rogers, *J. Am. Oil Chem. Soc. 67*:804 (1990).
4. Sampugna, J., Pallansch, L.A., M.G. Enig and M. Keeney, *J. Chromatogr. 249*:245 (1982).
5. Slover, H.T., R.H. Thompson, Jr., C.S. Davis and G.V. Merola, *J. Am. Oil Chem. Soc. 62*:775 (1985).
6. Hudgins, L.C., J. Hirsh and E.A. Emken, *Am. J. Clin. Nutr. 53*:474 (1991).

W.M.N. Ratnayake
Bureau of Nutritional Sciences,
Food Directorate,
Health and Welfare Canada,
Ottawa, Ontario,
Canada K1A 0L2

[Received October 17, 1991; accepted November 20, 1991]