Fatty Acid Analysis of Freshwater Fish Lipids

Sir:

A recent report in the *Journal of the American Oil Chemists' Society* directed attention to the n-3 fatty acids of freshwater fish from southern Brazil (1). I would like to point out to your readers that fish muscle lipids contain several n-3 and n-6 long-chain polyunsaturated fatty acids (PUFA) that have nutritional implications. The importance of these fatty acids to infant nutrition is particularly relevant because both arachidonic acid (20:4n-6, AA) and docosahexaenoic acid (22:6n-3, DHA) are important for fetal and term-infant neural development (2–4). Normally the AA and DHA are transferred to the nursing infant through maternal milk. Controlled experiments (5) have used a maternal dietary supplement of marine fish oil to enrich human milk in DHA and, recently, it has been shown that, in China, regional access to seafood marine lipids can lead to enrichment of human milk in DHA (6). On the other hand, AA showed only minor variations from region to region. This confirms that normally the AA in the milk PUFA can be synthesized from linoleic acid by the lactating female (7), providing AA as well as DHA, which are considered essential for the developing infant (2–7). Both AA and DHA can eventually become depleted in the nursing mother (4). We have recently shown in the rat that the AA of pup brain lipids can be maintained, relative to those from a diet based on soybean oil, through feeding the dam a freshwater fish oil that contained considerable AA, as well as DHA (8). In Brazil, there is a substantial freshwater fish industry, and during pregnancy this food could be recommended as desirable to build up the DHA in the mother. It might be considered, based on the fact that AA is not mentioned in the *JAOCS* publication (1), that supplemental AA would not be provided along with DHA by the freshwater fish in southern Brazil.

Qualitatively, the major fatty acids tabulated in *JAOCS* for fish found in southern Brazil appear to be generally correct for fish muscle lipids, although the number of entries "not detected" is disturbing. More to the point are several fatty acid identification problems, particularly the omission of AA from the tabulated data. I must point out that 20:3n-3 and 20:4n-6 fall in close proximity on polar gas–liquid chromatographic columns. Subtle differences in the polarity of liquid phases of packed columns, and in operating temperatures, affect the relative positions of 20:3n-3 and 20:4n-6 (9), but on polyglycol-coated open-tubular columns of the type used by the authors, 20:3n-3 falls after 20:4n-6 and before 20:4n-3 (10). AA is normally present in lipids of freshwater fish from temperate latitudes in a ratio to DHA ranging from 0.5:1 to 1:1 (11), and this AA is always accompanied by a similar proportion of eicosapentaenoic acid (20:5n-3, EPA) (12–14). The latter fatty acid is somewhat erratically reported by Andrade *et al.* (1). It would be presumptuous to attempt to rectify many of the fatty acid compositions tabulated for Brazilian fish (1) by moving numbers around. The warmer climate may affect the fatty acids of fish food organisms, as well as the physiology of the fish. However, high proportions of 20:2n-6 are dubious, and the numbers for 20:2n-6 probably should then be converted to either 20:3n-6 or to 20:4n-6 in cases where 20:3n-3 is also listed as "ND" (not detected). I feel that, generally, there is a firm basis for replacing 20:3n-3 with 20:4n-6 in this report. The latter fatty acid has, of course, dietary and health implications beyond concerns for infants (15,16). This is also true of EPA, usually associated with adult health problems, such as cardiovascular disease (17,18), and freshwater fish lipids may also be an important source of that fatty acid in the diet of that sector of the Brazilian population.

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