Dear Sir:

I propose 2 downward adjustments to the data in the otherwise superb study on omega-3 and omega-6 fat intake trends by Blasbalg et al (1) that appeared in the May issue of the Journal. Both adjustments refer specifically to soybean oil. The authors indicate that in 1999 this oil was the predominant dietary source of omega-6 fat intake estimates for soybean oil.

The ALA in soybean oil is prone to oxidation, causing rancidity in foods containing the oil. Hydrogenation converts ALA to more stable forms (5, 6). The use of hydrogenation to reduce the concentration by two-thirds produces an oxidation-resistant frying oil. But fried products that are stored before eating and frying oil that is used repeatedly require even lower amounts of ALA in the oil. In addition, partial hydrogenation to convert the liquid oil into a semi-firm shortening destroys most of the ALA.

Immediately before 2006, when mandatory trans fat labeling of packaged foods went into effect, ~40% of soybean oil was partially hydrogenated (7). There were no commercially available hydrogenated fats and oils in 1909. Crisco, the first hydrogenated oil, was introduced by Procter and Gamble in 1911. The amounts of ALA and LA in a number of products made with hydrogenated soybean oil are listed in Table 1. For comparison, amounts are also given for unhydrogenated soybean oil. These data are from the National Nutrient Database for Standard Reference, release 23 (8).

Some of the data specify ALA and LA. Both fats have all of their double bonds in the cis form. But some of the data are for fats described as 18:3 undifferentiated and 18:2 undifferentiated, and these may contain both cis and trans forms. These data are indicated with a superscript “1” in Table 1 and may overstate the actual amounts of ALA and LA.

In a study that compared unhydrogenated soybean oil and partially hydrogenated soybean oil from the same manufacturer (9), LA content dropped from 52.5% to 16.6% of total fat. There were no commercially available hydrogenated fats and oils in 1909. Crisco, the first hydrogenated oil, was introduced by Procter and Gamble in 1911. The amounts of ALA and LA in a number of products made with hydrogenated soybean oil are listed in Table 1. For comparison, amounts are also given for unhydrogenated soybean oil. These data are from the National Nutrient Database for Standard Reference, release 23 (8).

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In a study that compared unhydrogenated soybean oil and partially hydrogenated soybean oil from the same manufacturer (9), LA content dropped from 52.5% to 16.6% of total fat. ALA content dropped from 7.5% to 0.7%. It appears reasonable to suggest that, on average, ~80% of the ALA and 50% of the LA are converted to other fatty acids. There is no recognition of these losses in Blasbalg et al (1).

As a rough estimate, omega-3 fat (ALA) consumption from soybean oil in 1999 was probably slightly less that half of what the authors reported. For the omega-6 fat (LA), it was probably slightly more that half.

THE SECOND ADJUSTMENT IS FOR LOSS OF BOTH ALA AND LA DUE TO PARTIAL HYDROGENATION

The ALA in soybean oil is prone to oxidation, causing rancidity in foods containing the oil. Hydrogenation converts ALA to more stable forms (5, 6). The use of hydrogenation to reduce the concentration by two-thirds produces an oxidation-resistant frying oil. But fried products that are stored before eating and frying oil that is used repeatedly require even lower amounts of ALA in the oil. In addition, partial hydrogenation to convert the liquid oil into a semi-firm shortening destroys most of the ALA.

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Blasbalg et al (1) undertook the difficult task of assessing omega-3 and omega-6 consumption at the beginning and end of the 20th century. At the end of the century, excessive waste and hydrogenation losses from the major source of these essential fats made their task even more difficult than anticipated.

The author had no conflicts of interest to declare.

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REFERENCES


doi: 10.3945/ajcn.111.022095.

LETTERS TO THE EDITOR

Reply to R Perlmutter

Dear Sir:

We would like to address the 2 adjustments proposed by Perlmutter regarding the data on soybean oil reported in our recent article (1).

ADJUSTMENT TO RATIONALIZE AVAILABILITY COMPARED WITH CONSUMPTION

Perlmutter states that “[c]aloric availability and intake were similar in 1909 . . . [but] in 1999 they were not” and contends that our model assumes uniform discrepancies for both years, thereby overestimating actual consumption of linoleic acid (LA) and α-linolenic acid (ALA) to a greater extent at the end of the century than at the beginning. We do agree that differences between the availability and intake of calories, and therefore nutrients, vary over the time span. However, we do not agree with the specific modifications proposed to account for these differences. We would also like to point out that the constants we applied were not uniform over time, per the standard methodology of the Center for Nutrition Policy and Promotion (CNPP).

The author proposes that actual consumption of calories from fat was 82% of the total available in 1909 [880 compared with 1080 kcal · person⁻¹ · d⁻¹ calculated for 1909–1919 (2)], whereas in 1999 actual consumption was 53% of the total available [770 compared with 1449 kcal · person⁻¹ · d⁻¹ (2)]. However, although the source of data for the available calories from fat is clearly identified (2), it is unclear how the actual consumption of calories from fat was derived. Perlmutter assumes actual per capita consumption was 2200 kcal/d with 40% fat in 1909 and 2200 kcal/d with 35% fat in 1999, without references. To our knowledge, the gold standard for estimating actual consumption is the NHANES database, which dates only to the early 1960s (3). Similar data are not available for 1909. In 1999 estimated actual per capita consumption was 2146 kcal/d with 32.7% fat (4). As reported in our article, the essential fatty acid composition of the 1999 diet is well aligned with NHANES data on a percentage of energy basis (1).

We wish to clarify that our determinations were not based on uniform discrepancies in 1909 and 1999. Per the CNPP methodology, constants were not applied per year but rather varied per food. As described in our Methods, the constants for several food products changed at various points throughout the time span, in some cases as often as every 5 y, to account for changes

| TABLE 1 |

| Amounts of ALA and LA in products made with hydrogenated soybean oila |
|-----------|--------|--------|
| Product | LA | ALA |
| Oil, soybean, salad, or cooking (not hydrogenated) | 6.8 | 50.4 |
| Oil, soybean, salad, or cooking (partially hydrogenated) | 2.6 | 34.9 |
| Shortening, industrial, soy (partially hydrogenated), pourable liquid fry oil | 2.5 | 32.2 |
| Shortening, special purpose for cakes and frosting, soybean (hydrogenated) | 2.2 | 35.8 |
| Margarine, regular, hard, soybean (hydrogenated) | 1.9 | 24.1 |
| Shortening, frying (heavy duty), soybean (hydrogenated), linoleic (<1%) | 0.1 | 0.3 |
| Shortening, industrial, soy (partially hydrogenated), for frying and confections | 0.0 | 2.7 |

a ALA, α-linolenic acid; LA, linoleic acid.

b May contain both cis and trans forms.