

Stephen C Cunnane

Origins and evolution of the Western diet: implications of iodine and seafood intakes for the human brain

Dear Sir:

Cordain et al (1) are to be congratulated on a succinct and topical overview, recently published in the Journal, of the perils of a Westernized diet with respect to the risk of chronic degenerative diseases in humans. Indeed, there is widespread support for reinstating several aspects of the so-called Paleolithic diet, especially higher fiber and lower content of refined, adulterated, or synthetic constituents. However, the authors do not seem to have made reference in their article to the effect of diet on a defining feature of modern humans—namely, the brain—whether that effect is related to brain development, advanced brain function, or risk of degenerative brain disease. Several micronutrients are discussed, but iodine seems to have been overlooked, despite the fact that it is 1 of the 2 nutrients (the other is iron) from which humans globally are considered to suffer the most common deficiency (2).

The most serious consequence of iodine deficiency is impaired neurologic development, a problem that most developed countries have avoided only by legislating the use of iodized table salt; commonly preferred food choices that exclude seafood simply do not provide enough iodine. Indeed, publications from Australia, the United States, and Europe during the past decade show that mild-to-moderate iodine deficiency is reemerging as people in developed countries consume less table salt, dairy products, meat, fish, and seafood (3–5).

Cordain et al gave an overview of the nutrient density in various major food groups in Table 4 of their article, but they made no mention of the relatively poor bioavailability of micronutrients, especially minerals, from some of these food groups. The concentration in plants of zinc or iron, without consideration of the phytate content of those plants, exaggerates the true value of plants as sources of these nutrients. Although iodine is not shown in Table 4, goitrogens in many cultivated plants greatly reduce the availability of iodine from plant-based diets. Hence, the overall ranking in Table 4 of seafood second to vegetables as a source of micronutrients underestimates the true value of seafood in protecting against the risk of the major nutrient deficiencies that affect humans. Among the food groups shown in the table, seafood actually has the highest available content of several minerals needed for brain development, including iodine, iron, zinc, copper, and selenium (6).

The focusing of some attention on the human health implications of declining iodine and seafood intakes is warranted because those declining intakes are directly linked to brain development. The modern-day vulnerability of the developing human brain to inadequate intakes of iodine, iron, docosahexaenoic acid, and several other brain-selective nutrients shows that, if seafood had not been a significant component of the Paleolithic diet, the modern human brain probably would not have evolved in the first place (6, 7).

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Reply to SC Cunnane

Dear Sir:

We thank Dr Cunnane for his congratulatory words about our recent article in the Journal (1). Clearly, in a review article of a somewhat limited nature, it would not be possible to comprehensively document all diseases and maladies of civilization that have been linked to the typical Western diet. Instead, we referred interested readers to Cordain's earlier, more exhaustive review of the numerous health problems and illnesses associated with the consumption of cereal grains, a food introduced in the relatively more recent Neolithic period (2). We agree with the notion that normal human brain development and function require a diet adequate in iron, iodine, and long-chain polyunsaturated fatty acids (PUFAs) of both the n–3 and n–6 families. Moreover, there is little doubt that animal foods, which were the dietary staples for historically studied hunter-gatherers (3, 4), are rich sources of these nutrients (1, 5, 6).

With respect to iodine and the brain's development and function, it should be pointed out that a wide variety of staple foods domesticated during the Neolithic period and later (ie, millet, maize, soy,

cassava, sweet potatoes, lima beans, turnips, cabbage, cauliflower, rapeseed, mustard, onion, garlic, bamboo shoots, and palm tree fruit) contain a variety of goitrogens (7, 8) that may elicit symptoms of iodine deficiency despite adequate iodine intakes (7, 9). Hence, plant food-dominated diets containing goitrogens, which were adopted by humanity after the agricultural revolution, may play a significant role in impairing thyroid function and thereby adversely influencing human brain development (10). In contrast, iodine deficiency is rare among traditional societies that consume animal-based diets (11).

For reasons we outlined previously (6, 12), we respectfully disagree with Cunnane's suggestion that seafood would have represented the primary source of long-chain PUFAs (22:6n-3 and 20:4n-6) and other micronutrients necessary to the relaxation of the selective pressure previously constraining encephalization in hominins. Exploitation of the marine environment is first documented in the archaeological record during the Middle Paleolithic period ($\approx 110\,000$ y BP), and stable isotope data show that inland aquatic foods were not utilized by hominins living in Europe until the mid-Upper Paleolithic period ($\approx 28\,000$ – $20\,000$ y BP) (13). Hence, aquatic animal foods, whether ocean- or inland-derived, would have played a minor role in providing nutrients that were crucial to the rapid hominin brain expansion that occurred during the Early Paleolithic period (≈ 2.5 – 2.0 million y BP). Rather, terrestrial animal foods (including muscle, brain, marrow, thyroid gland, and other organs) would have represented the primary source of long-chain PUFAs, iron, zinc, iodine, and other nutrients that were necessary for encephalization and normal brain development (6, 12, 14).

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