Vegetarian diets and exposure to organochlorine pollutants, lead, and mercury

Dear Sir:

The practice of feeding animal meat and bone meal to cattle has been linked to the recent epidemic of bovine spongiform encephalopathy. Bovine spongiform encephalopathy, in turn, has been linked to the human prion disease variant Creutzfeldt-Jakob disease (1). In that recent issue of the Journal, Trevitt and Singh introduced an interesting issue that has escaped previous discussions regarding vegetarian diets and human health. Not only are harmful prions found in the meats of animals that have consumed animal products, but also found in these meats are persistent lipophilic organic pollutants (PLOP), such as pesticides, polychlorinated dibenzo-p-dioxins, dibenzofurans, polychlorinated biphenyls, and polybrominated compounds. Animal products can also contain other neurotoxic substances, such as monomethyl mercury (MMHg) and lead.

Substances that are resistant to degradation and that are released in the environment accumulate in the food web and often end up being consumed by humans. The chemical characteristics of these persistent pollutants determine the location of accumulation, the metabolism, and the half-time within animal tissues. Lipophilic substances such as PLOP accumulate in fat tissues, whereas lead accumulates in bones as a function of age and diet. Although organochlorine pesticides are a significant contaminant of animal products, the major carriers of these harmful substances (2). MMHg is also a fat-soluble substance, but it is complexed with hydrophilic sulfhydryl-containing molecules of protein matrices in animal tissues. A series of chemical reactions involving mercury and sulfate-reducing bacteria produce MMHg, which is then introduced in the aquatic food chain and is thereby acquired by humans through the consumption of fish and shellfish. Animals and humans share some of the bioaccumulation features of these persistent substances, but, because of different dietary habits, humans may or may not be exposed to them.

The trend among affluent countries is to feed animal byproducts to poultry and ruminants (herbivores such as cows, sheep, and goats). These animals are used in milk production or are consumed as meat. Fishmeal is mainly used as feed for dairy cows (3). Fishmeal consumption results in an increase in milk production and stimulates an increase in docosahexaenoic and eicosapentaenoic acids (4). Cow feed may also contain significant proportions of bone meal (5).

The health benefits of vegetarian diets have been a topic of health and nutrition research since long before the emergence of modern environmental concerns. However, because of increases in environmental pollution, dietary habits have become an increasingly important public health issue. Studies have shown that a primarily vegetarian diet results in decreased exposures to bioconcentrated environmental pollutants. Vegetarian mothers have been shown to secrete substantially fewer organochlorine substances in breast milk than do nonvegetarian mothers (6). Environmental estrogenic substances (polychlorinated biphenyls and phthalate esters) have been found in human serum in the following relative concentrations: urban fish eaters > rural fish eaters > urban vegetarians > rural vegetarians (7). Vegetarian vegans from Hong Kong who consumed no fish or shellfish were shown to have very low concentrations of hair mercury compared with nonvegetarians (8). Passos et al (9) suggest that an increased consumption of fruit can lower the body burden of mercury in Brazilian Amazon fish-eating populations. After 12 mo of changing from an omnivorous diet to a lactovegetarian diet, healthy adults had decreased hair concentrations of mercury and lead (10). Therefore, a predominance of plant food in human diets is an important step in lowering the body burden of harmful substances in populations exposed to pollutants.

Strict vegetarianism, or veganism, is defined as the practice of consuming plant food only (no animal products). However, variants of vegetarianism—such as lactovegetarianism—involves the practice of consuming eggs and dairy products. Although a vegetarian lifestyle can lower the body burden of PLOP, MMHg, and lead, such benefits can be undermined by the consumption of contaminated milk and egg products. Farm animals that have been fed contaminated animal products produce contaminated milk and egg products.

In summary, the inclusion of animal products in some forms of vegetarianism can increase the exposure of humans to persistent pollutants. Vegetarians with a desire to reduce their exposure to neurotoxic substances (eg, PLOP, MMHg, and lead) should be aware of farming practices that introduce these pollutants into the human diet.

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REFERENCES
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Erratum


On page 290, column 2, paragraph 3, the unit “mL” is used incorrectly in 4 instances; the correct unit is “μL.” The text should have been presented as follows: Briefly, 100 μL plasma was mixed with 100 μL ethanol; after being mixed by vortex, tocopherol was extracted into 500 μL hexane containing 0.002% butylated hydroxytoluene (Sigma, St Louis). Tocol, a gift from Hoffmann-La Roche (Nutley, NJ), was added to the mixture as an internal standard. Samples were centrifuged at 180 × g for 5 min at 4 °C. The supernatant fluid was collected and dried under a stream of nitrogen gas and was reconstituted in 100 μL methanol.